Results of an Inventory of the Vascular Plants of Yukon-Charley Rivers National Preserve

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Chapter 5 Summary of Inventory Results

In the pages that follow we present a summary of the data we collected on vascular plant species distribution and floristics of Yukon-Charley Rivers National Preserve. The data used for these analyses included all the data collected during the 2002 vascular plant inventory and a subset of the data exported from the Automated National Catalog System Plus (ANCS+) for Yukon-Charley Rivers National Preserve. Many of the vouchered specimens documented in ANCS+ did not contain detailed locality information; these specimens were not included in data analyses because we could not accurately define the appropriate physiographic region with which they were associated. The analyses we present here regarding species distributions are somewhat conservative since the data included in this report represent only a portion of the data known for the Preserve. Vouchered specimens collected within the Preserve boundaries are housed in several herbaria around the country and the data on these specimens were not readily available for inclusion in this report. Of particular importance are collections that reside at the University of Alaska Herbarium and the Center for Northern Studies in Vermont. As such it is important to understand that inferences we make here apply solely to the data included in these analyses.

We surveyed 135 sites (Figure 4.1) in Yukon-Charley Rivers National Preserve during the summer of 2002. Approximately 820 hours were spent collecting and documenting voucher specimens at these sites. More than 2500 specimens were collected during this survey effort. Of these, 2137 were prepared as permanent voucher specimens. The inventory efforts were concentrated in five targeted study areas:

1. 18 sites in wetland and aquatic habitats in the Yukon River lowlands
2. 22 sites along gravel bars and river terraces in the Yukon River corridor
3. 23 sites in alpine areas on calcareous bedrock in the Ogilvie Mountains and alpine seeps
4. 29 alpine sites in the Yukon–Tanana Uplands (generally on crystalline bedrock)
5. 14 subalpine sites in the Upper Charley River Mountain and Three Fingers ecoregion subsections

Until this time, these areas had been poorly surveyed for vascular plants and were identified as high priority sites for the 2002 inventory. An additional 29 sites were surveyed in the Yukon River floodplain, along the Nation and Kandik rivers, and in the Biederman Hills. Sites were located in eight of the 14 ecological subsections (Table 5.1).

plant species that are not likely to be found in the Preserve yet appeared on the expected species list. As a result the expected list was somewhat inflated.

A simple metric of completeness for this inventory is to compare the known and expected species list before and after the inventory. Prior to the plant inventory, 447 taxa were known to be present in the Preserve and after, 674 taxa. Combined, the known and expected list predicted there to be 718 taxa in the Preserve. To date we have collected 93.9% of the number of taxa expected/known to be in the Preserve. This measure of completeness is not without problems. Although the new list of taxa for the Preserve contains nearly 94% of the number of taxa expected, it includes only 77% of the actual taxa expected. The disparity between these two numbers demonstrates that this method is not effective in assessing the completeness of this inventory largely because there is no simple way to geographically determine an expected species list. The distance method used by this project resulted in problems of inclusion and exclusion despite efforts made by AKNHP and park staff to reduce many of these errors before the study started (for example, excluding from the list plants particular to substrates not found in a Park unit). A more subjective, but potentially more telling, measure of completeness is determining whether the inventory was still finding new species. During the final days of the field portion of the inventory we were still documenting new species to the Preserve. This combined with the low number of taxa found from the expected species list suggests more work is necessary to thoroughly document the Preserve flora.

Directions for future floristic work in Yukon-Charley Rivers National Preserve

This inventory effort has greatly expanded our understanding of vascular plant biodiversity and biogeography in the Preserve. And, as a result, we have learned much about the distribution of rare and endemic plant species. Furthermore, this survey has dramatically reduced the geographic data gaps; this in turn has allowed us to interpret the biogeography of plants here and better delineate the data gaps that remain. The following recommendations are made to reduce the persisting data gaps and improve our understanding of the vascular plant flora in the Preserve: 1) continued surveys in under-surveyed sites and, 2) careful review of the expected species list.

Despite rigorous efforts to extensively survey the entire Preserve during the 2002 field season, there are a few areas that have yet to be surveyed. The largest gap in our understanding of the flora persists in the hills on the south side of the Yukon River. These sites were largely overlooked during this survey because the area consists primarily of boreal forest and taiga that has been extensively surveyed throughout much of interior Alaska, and we predicted few new species would be found in this area. To more fully complete this inventory, we recommend surveying areas in the Little Black River Hills which are in the northwestern most section of the Preserve; the Charley Foothills which is an extensive area that had only one survey site and is located in the hills south of the Tintina Fault; and the Tintina Hills which are sandwiched between the Yukon River and the Tintina Fault. Also parts of the Upper Charley Mountain Tundra subsection have received very little attention including areas around Twin Mountain and around the headwaters of Thanksgiving, Weber, Woodchopper, and Beverly Creeks. These sites may garner few new plant species but a survey here would certainly improve the Preserve's understanding of vascular plant species distribution.

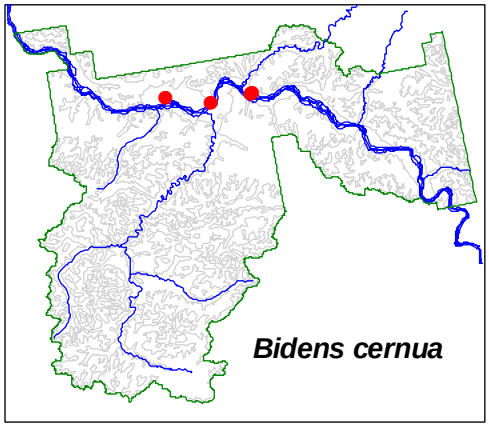
Until this time, the floristic diversity of wetlands along this section of the Yukon had largely been ignored; this survey marked the first opportunity in which concerted efforts were made to document wetland vegetation within the Preserve. This strategy was very successful. The most significant collections that were made during this inventory were the additions to the known wetland flora. Yet several gaps persist in our understanding of the vascular plant flora in wetland ecosystems. Despite our efforts to successfully survey these sites we were still locating new species in the final days of surveying aquatic ecosystems. This suggests that additional survey efforts still need to be made within these sites to locate new taxa. Not only did wetlands harbor a large number of rare plant species but several noteworthy wetland sites were identified during the inventory including wetlands at the base of Kathul Mountain, the mouth of the Kandik River, old bogs in Andrew Creek Flats and the Tacoma Bluff area. These sites contained unexpected assemblages of species as well as harboring numerous rare plant species. The identification of these diverse sites begs the two following questions: 1) are these sites unique? and 2) why are these particular wetland areas so diverse? Identification of these questions poses an interesting opportunity for future work at these sites. Many of the unique wetland plant species collected during this survey were near the mouth of the Kandik River just downstream from Kathul Mountain, an area known for its floristic diversity. These collections suggest this old landscape may be a wetland refugium that warrants further research. Finally, the vast majority of wetlands surveyed were accessed from the Yukon River via river boat; few wetland areas along the Nation, Kandik and Charley Rivers were surveyed. More extensive surveys in wetlands along these rivers, the Tatonduk River, and along major creeks would dramatically improve the understanding of plant species distribution within the boundaries of the Preserve.

One of the more complicated problems we had interpreting the data from this survey was closely tied to the accuracy of the expected species list. The list was intended to be used in two specific ways. First, if used properly, the list could help field botanists target specific habitats to survey. And second, the list could be used as a measure of completeness. Because the list was wrought with problems of both inclusion and exclusion of species its utility in accurately assessing the inventory completeness was compromised. A careful analysis of each species on the expected species list might help alleviate some of these problems. Additional work evaluating each species for inclusion and predicting where suitable habitat lies within the Preserve would greatly enhance the accuracy of our assessment of completeness. This process would be helpful in predicting where these plants might reside in the Preserve and where to concentrate future collection efforts. However, investing time into developing and implementing a more statistically valid means of assessing survey completeness would likely be more productive. A systematic survey in which probability based models were used to design a rigorous sampling strategy could address other aspects of plant ecology like species associations, distribution, abundance and community ecology as well as provide an estimate of sight ability and increase the value of inventory data. These techniques would be very valuable for providing more detailed information about the Preserve vegetation and provide a sound base for a long term monitoring program.

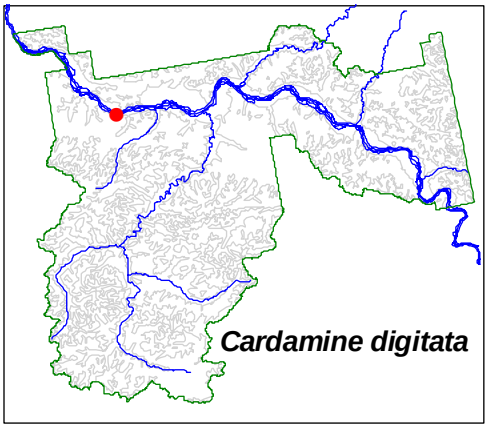
A final recommendation for future botanical work is additional effort to assemble all known collection data that currently reside at the University of Alaska Herbarium and the Center for Northern Studies in Vermont. These two institutions are responsible for housing a massive collection of data for Yukon-Charley Rivers National Preserve. This data would be extremely

valuable in a more complete analysis of the Preserve flora. Without which we can only make conservation estimates regarding species distribution.

Map 1



Map 2



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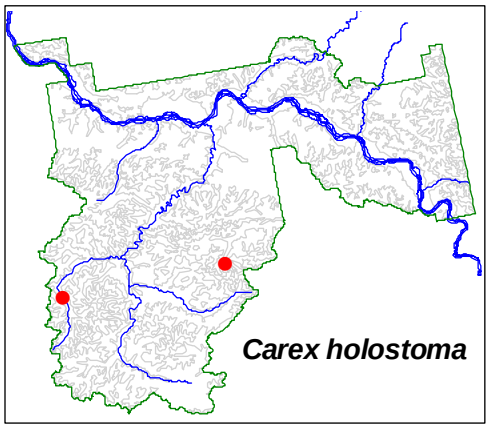

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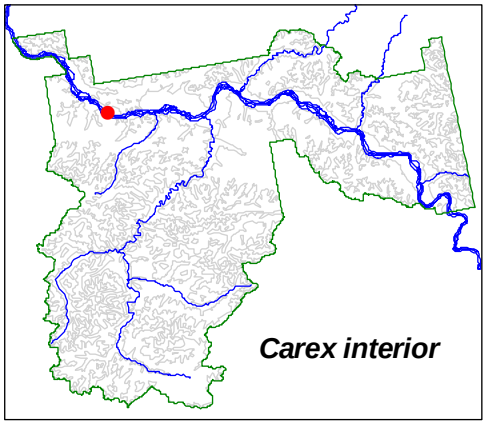

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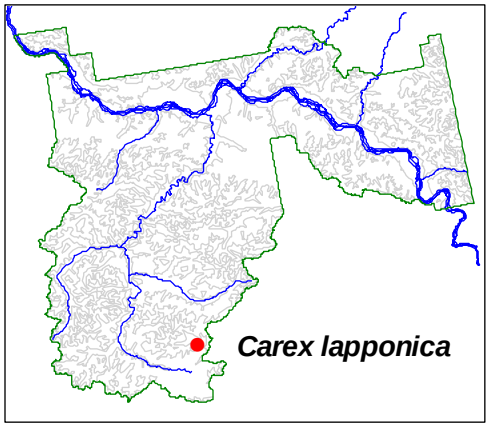
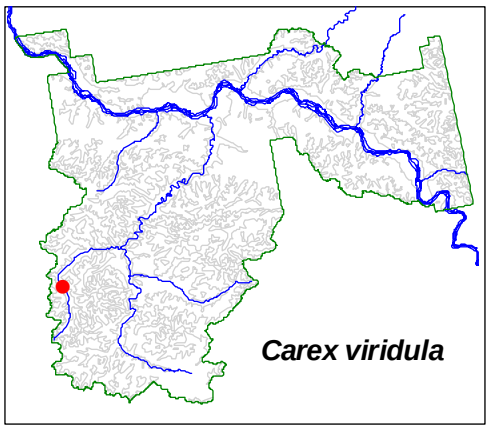


Map 6

Figure 5.3. Maps showing sites where collections of notable species were made in 2002. Red dots indicate collection sites, blue lines show major rivers, and green line indicates outline of Yukon-Charley Rivers National Preserve.



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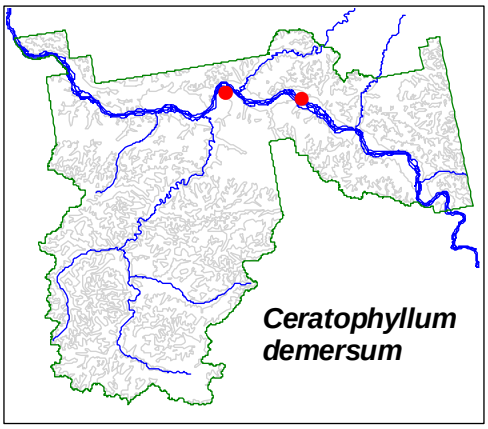

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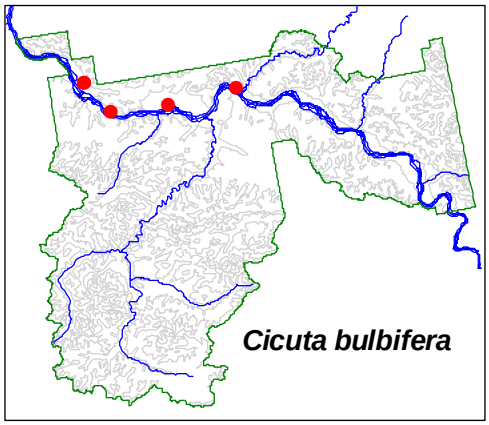

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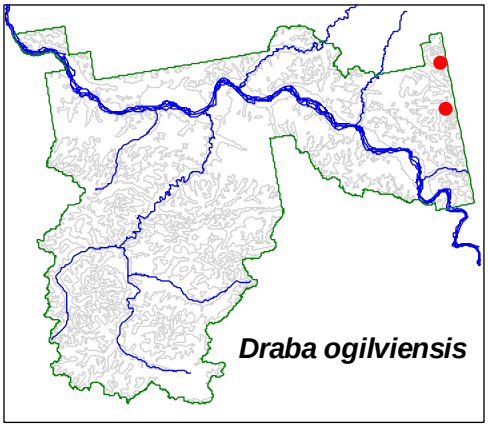

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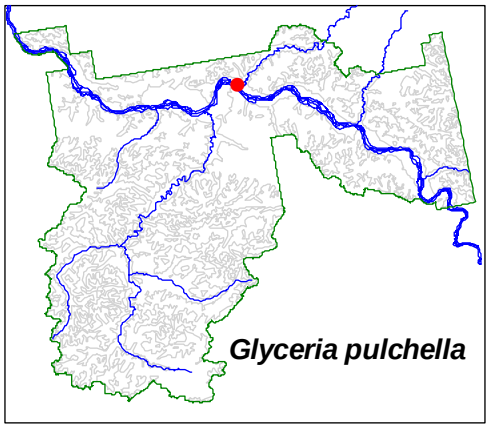

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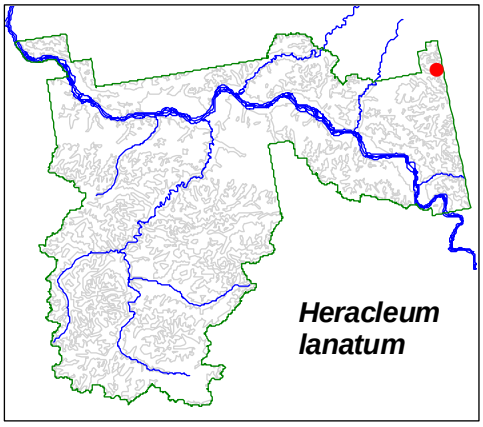

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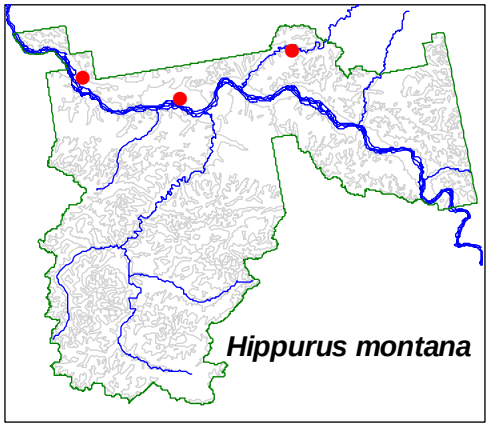

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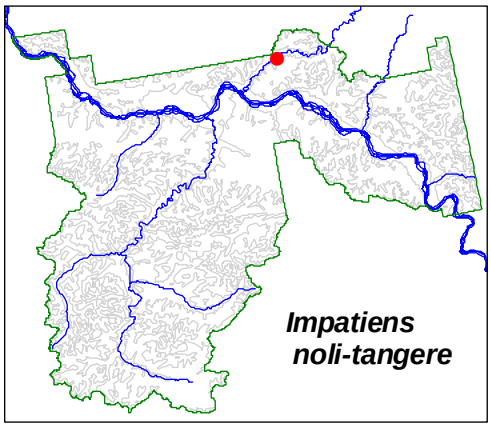

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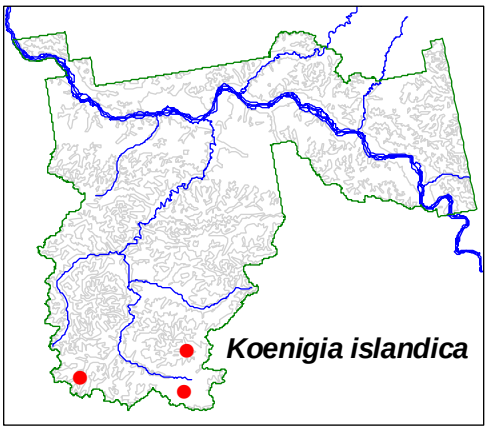

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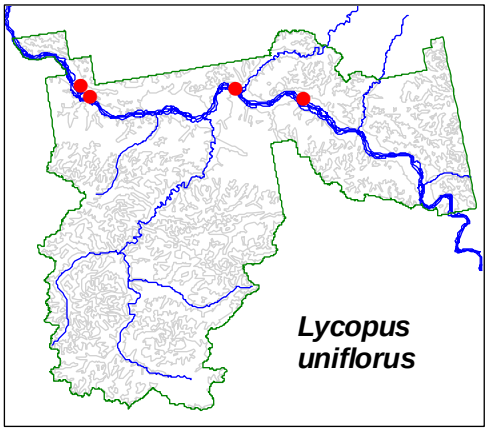

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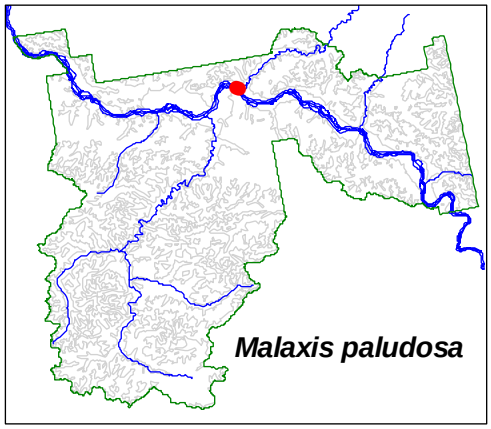

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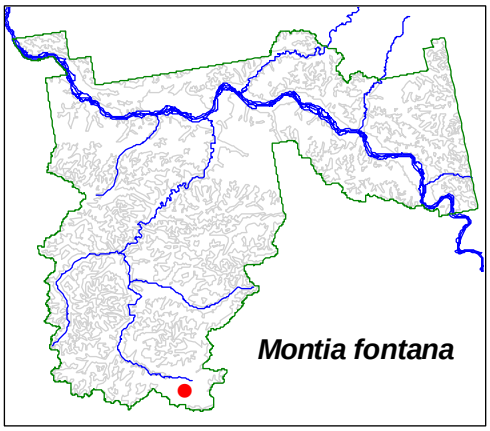

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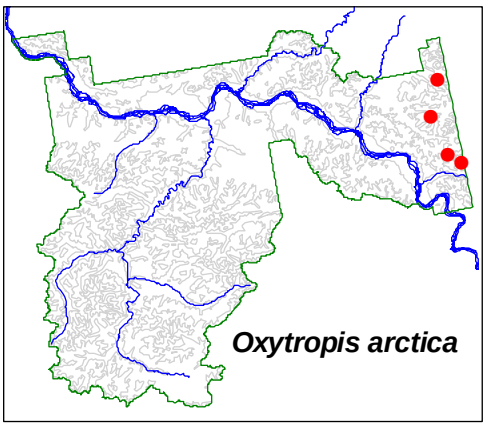

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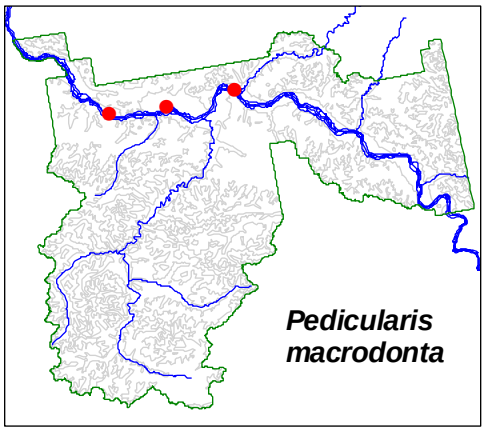

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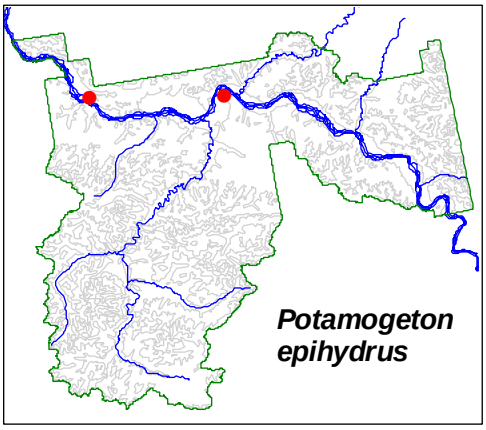

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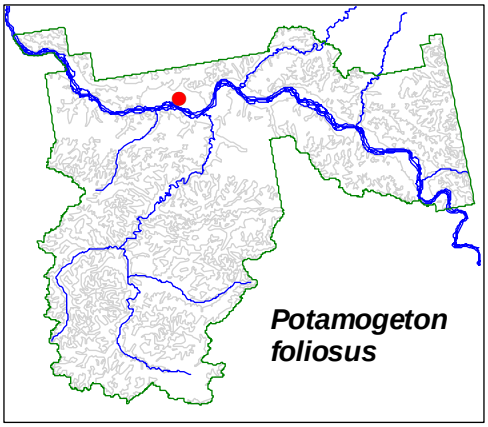

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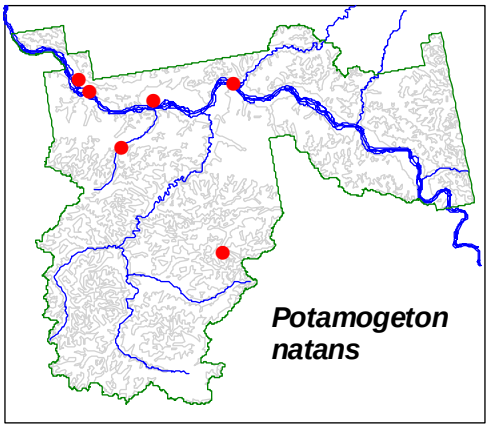

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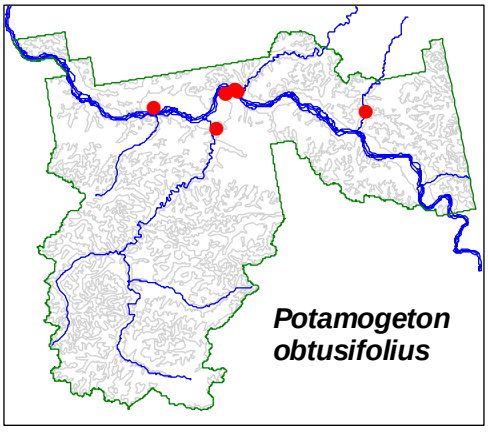

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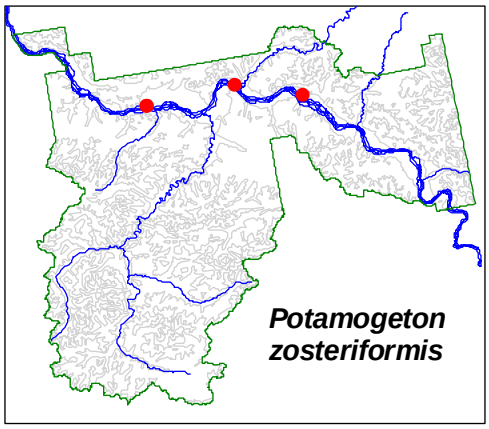

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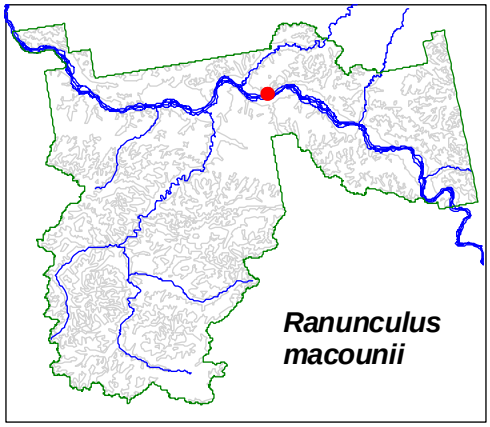

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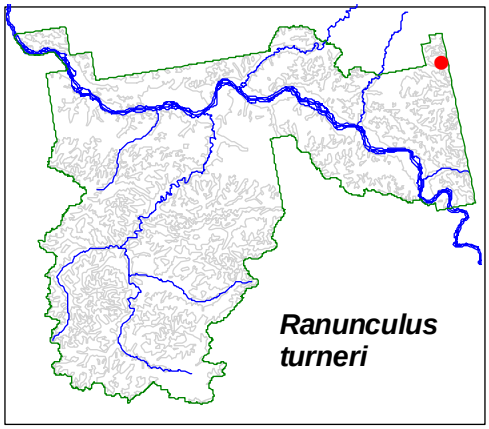

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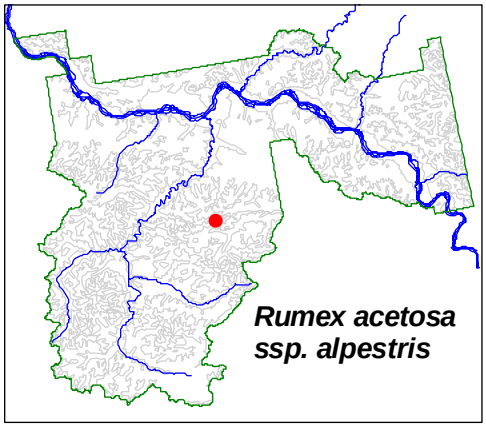

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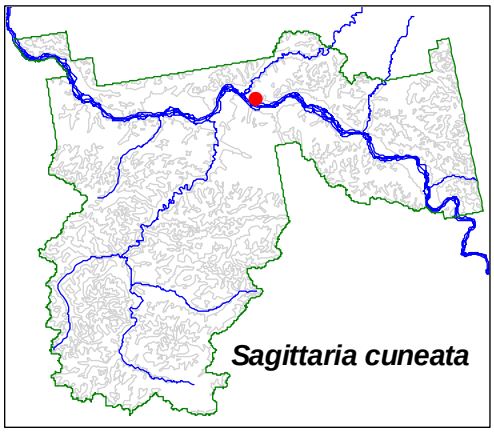

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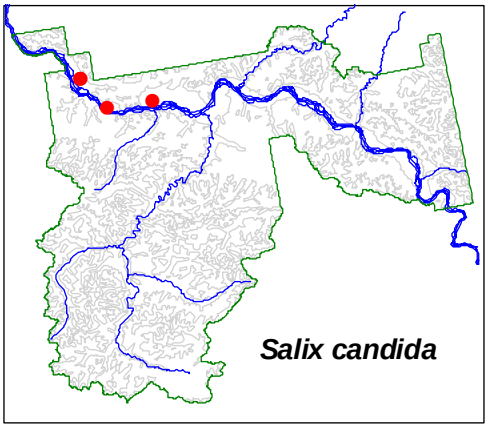

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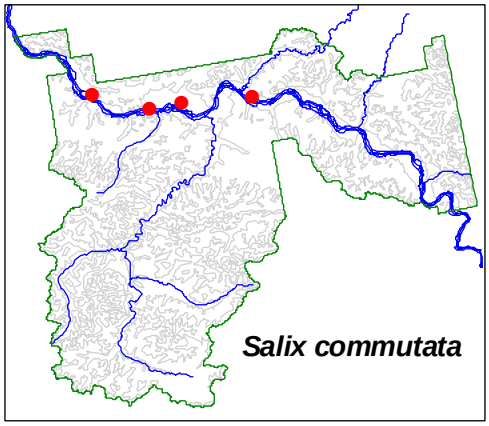
Figure 5.3 (continued). Maps showing sites where collections of notable species were made in 2002. Red dots indicate collection sites, blue lines show major rivers, and green line indicates outline of Preserve.



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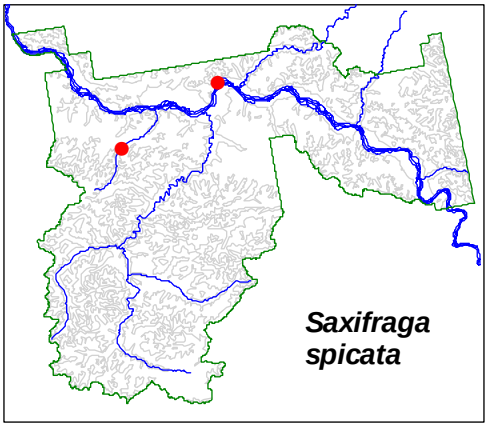

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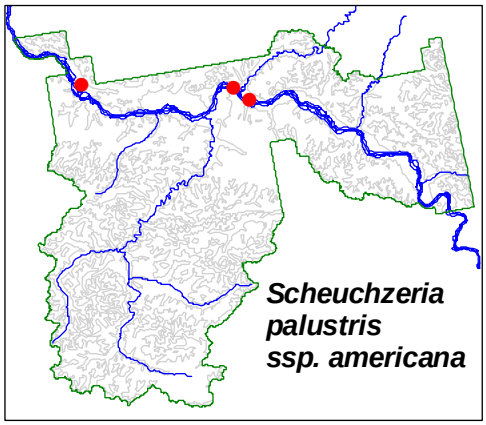

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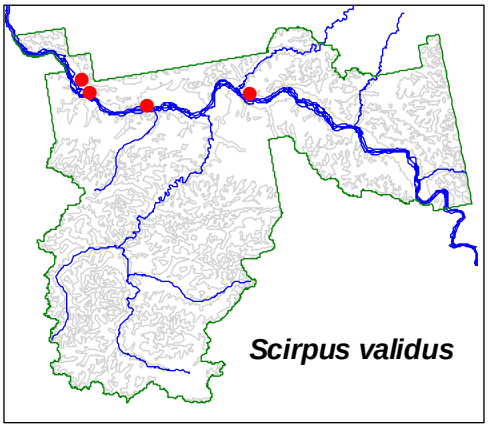

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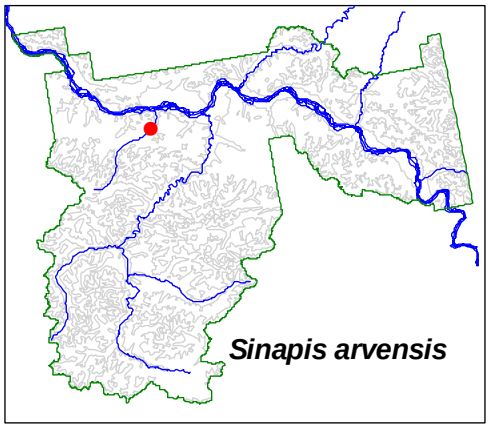

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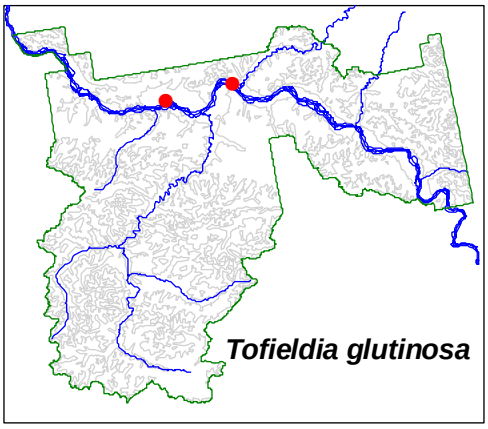

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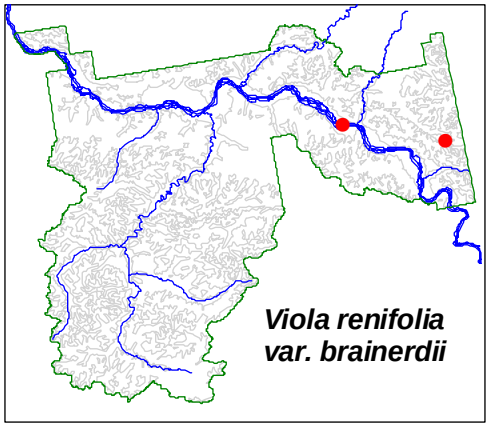

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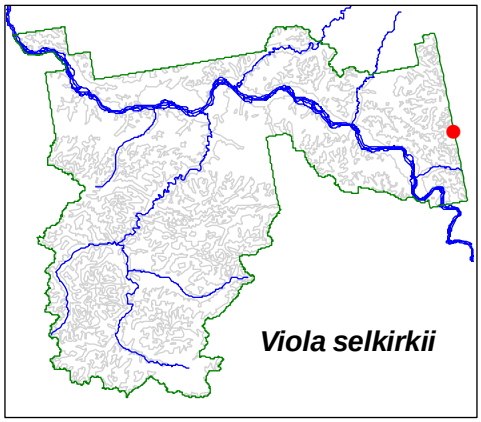

Map 38

Figure 5.3 (continued). Maps showing sites where collections of notable species were made in 2002. Red dots indicate collection sites, blue lines show major rivers, and green line indicates outline of Preserve.

ACKNOWLEDGEMENTS

No project of this size can be accomplished by a pack of hyenas rather it must be done by a collection of individuals that dedicate themselves to the project and persevere in following the data from planning to reporting. Over the course of this project we received help from a diverse array of people, agencies and institutions to whom we owe a great deal of gratitude. Because so many were involved in this project it is impossible to individually thank each person. And because the roles of contributors have evolved over time it is difficult to accurately account for everyone's contributions. Every person who contributed to this project made sacrifices and for that we are very thankful. Here we have tried to outline the contributions of each major contributor and to thank them for these contributions. To those we don't mention specifically we extend our gratitude. We hope that these acknowledgments accurately portray the contributions of everyone involved and that we have captured the spirit of cooperation that existed throughout this entire process.

Much assistance was provided by the University of Alaska Herbarium staff especially by collection manager **Alan Batten** who spent endless hours surveying sites, processing specimens in the field, and finally carefully tracking our specimens throughout the entire accessioning process (taking care of the dribs and drabs as he so kindly stated) and research associate **Carolyn Parker**, who verified countless specimens and graciously answered numerous questions regarding the floristics of Alaska. We are very thankful for the impressive work that this institution and its staff have provided us.

National Park Service botanists **Mary Beth Cook**, Wrangell-St. Elias National Park and Preserve, and **Carl Roland**, Denali National Park and Preserve, played pivotal roles throughout the entire course of this project. Together they formed the nucleus of the project by successfully purporting the necessity of inventorying vascular plants in these remote parks, writing the study plan and developing the survey technique. During this process they identified major data gaps in our understanding of the vascular plant flora in the three network parks, designed appropriate field sampling strategies, designed a routine database management system, outlined data analysis routines, and developed collection management and curation methodologies. Mary Beth participated in several other important phases of this project: she contributed a great deal of her time to conducting the field portion of the inventory; collected nearly one third of the specimens documented in this inventory; and identified specimens, entered data, and prepared labels for them. She developed the database that we used for storing and analyzing data for this inventory and prepared the data for export to ANCS+. Carl also contributed significantly to this project. He did an exceptional job in the early stages of the Yukon-Charley inventory especially during the field planning efforts. He prepared all park compliance documents, secured permits, and identified suitable sites in the Preserve for inventory. He also spent two weeks collecting specimens that he identified, entered data and prepared labels for. He helped extensively in the preparation for this document by providing guidance on data analysis, design and layout, and map preparation. Finally, he allowed us to use his report, The Vascular Plant Floristics of Denali National Park and Preserve (Roland 2004), as a template for this document saving us a great deal of time

and effort. Most importantly we thank Mary Beth and Carl for sharing with us their tireless enthusiasm for botany and their detailed knowledge of both the flora of Alaska and the Preserve.

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Appendix A

List of new vascular plant taxa vouchered for Yukon-Charley Rivers National Preserve during 2002 vascular plant inventory

*12 families new to the Preserve
**43 genera new to the Preserve
-Taxa in **bold** were not included in the "expected list" prepared by AKNHP of species previously found within 50 km of the Preserve and expected to be found in the Preserve.

Alismataceae*
- ***Sagittaria*** ** *cuneata* **Sheld**.

Apiaceae
- ***Cicuta*** ** *bulbifera* **L.**
- *Cicuta virosa* L.
- ***Heracleum lanatum* Michx.**

Araceae
- ***Calla*** ** *palustris* **L.**

Asteraceae
- *Achillea sibirica* Ledeb
- ***Antennaria alpina* (L.) Gaertn**
- *Arnica lessingii* Greene
- *Aster junciformis* Rydb.
- ***Bidens*** ** *cernua* **L.**
- ***Erigeron glabellus* ssp. *pubescens* Nutt.**
- ***Packera*** ** *streptanthifolius* **W. A Weber & A. Löve**
- ***Petastites sagittatus* (Banks) Gray**
- *Senecio atropurpureus* (Ledeb.) Fedtsch.
- ***Senecio fuscatus* (Jord. & Fourr.) Hayek**
- ***Senecio kjellmanii* Porsild**
- *Senecio pauciflorus* Pursh
- ***Senecio pauperculus* Michx.**
- ***Solidago lepida* DC.**
- *Tanacetum bipinnatum* ssp. *huronense* (L.) Schultz-Bip
- *Taraxacum alaskanum* Rydb.
- ***Taraxacum kamtschaticum* Dahlstedt**
- ***Taraxacum phymatocarpum* J. Vahl.**

Balsaminaceae *
- ***Impatiens*** ** *noli-tangere* **L.**

Betulaceae
- *Alnus tenuifolia* Nutt.
- ***Betula neoalaskana* Sarg.**
- *Betula papyrifera* Marsh.

Boraginaceae
- *Eritrichium** aretoides* (Cham.) DC.
- *Myosotis** alpestris* F.W. Schmidt

Brassicaceae
- ***Arabis kamchatica* (Fisch. ex DC.) Ledeb.**
- ***Cardamine digitata* Richards.**
- ***Cardamine umbellata* Greene**
- *Draba alpina* L.
- ***Draba crassifolia* Graham**
- *Draba fladnizensis* Wulf.
- *Draba lonchocarpa* Rydb.

Draba longipes Raup
Draba stenopetala Trautv.
*Eutremia** edwardsii* R. Br.
*Halimolobus** mollis* (Hook.) Rollins
***Sinapis** arvensis* **L.**

Callitrichaceae *
***Callitriche** hermaphroditica* **L.**
*Callitriche** verna* L. emend. Lonnr.

Campanulaceae
Campanula lasiocarpa Cham.

Caryophyllaceae
***Melandrium** affine* **J. Vahl.**
***Melandrium** apetalum* **(L.) Fenzl**
Minuartia biflora (L.) Schinzl. & Thell.
Minuartia dawsonensis (Britt.) Mattf.
Minuartia elegans (Cham. & Sclecht.) Schischk.
Minuartia macrocarpa (Pursh) Ostenf.
Stellaria calycantha (Ledeb.) Bong.
Stellaria crassifolia **Ehrh.**
Stellaria laeta **Richards.**
Stellaria longfolia Muhl.
Stellaria monantha **Hulten**
Stellaria umbellata **Turcz.**

Ceratophyllaceae *
*Ceratophyllum** demersum* L.

Cornaceae
Cornus stolonifera **Michx.**

Cyperaceae
Carex atrofusca Schkuhr.
Carex bicolor **All.**
Carex brunnescens **(Pers.) Poir**
Carex canescens L.
Carex diandra Schrank.
Carex disperma Dewey
Carex foena **Willd.**
Carex garberi **Fern.**
Carex holostoma **Drej.**
Carex interior **Bailey**
Carex laeviculmis **Meinsh**
Carex lapponica Lang
Carex leptalea Wahlenb.
Carex limosa L.
Carex livida **Willd.**
Carex lugens Holm.
Carex media R. Br.
Carex microchaeta **Holm. ssp.** ***nesophila*** **(Holm.) Murray**
Carex oederi **ssp.** ***viridula*** **Retz.**
Carex praticola Rydb.
Carex rostrata Stokes
Carex tenuiflora Wahlenb.
Carex williamsii **Britt.**
Eleocharis acicularis (L.) Roem & Schult.
Eriophorum angustifolium Honck.
Eriophorum gracile **Koch.**
*Scirpus** validus* Vahl.
Trichophorum caespitosum **(L.) Hartm.**

Droseraceae
Drosera anglica Huds.
Dryopteridaceae
Gymnocarpium dryopteris (L.) Newm.
Equisetaceae
Equisetum fluviatile L. ampl. Ehrh.
Ericaceae
***Arctostaphylos rubra* (Rehd. & Wilson) Fern.**
*Oxycoccus*** *microcarpus* Turcz.
Fabaceae
***Oxytropis arctica* R. Br.**
***Oxytropis borealis* var. *borealis* DC.**
Oxytropis mertensiana Turcz.
Gentianaceae
Gentiana algida Pall.
Gentiana prostrata Haenke
*Menyanthes*** *trifoliata* L.
Haloragaceae *
***Hippuris montana* Ledeb.**
Hippuris vulgaris L.
*Myriophyllum*** *sibiricum* Komarov
Myriophyllum verticillatum L.
Juncaceae
***Juncus alpinus* Vill.**
***Juncus biglumis* L.**
Juncus bufonius L.
Juncus castaneus Sm.
***Juncus filiformis* L.**
Juncus triglumis L.
***Luzula arcuata* ssp. *unalaschensis* (Wahlenb.) Sw.**
Luzula spicata (L.) DC.
Juncaginaceae *
*Triglochin*** *maritimum* L.
*Triglochin*** *palustris* L.
Lamiaceae
Lycopus *uniflorus* Michx.**
Lemnaceae
Lemna minor L.
Lentibulariaceae
*Utricularia*** *intermedia* Hayne
***Utricularia minor* L.**
***Utricularia vulgaris* L.**
Liliaceae
***Tofieldia glutinosa* (Michx.) Pers.**
Lycopodiaceae
Diphasiastrum alpinum (L.) Holub
Huperzia *haleakalae* (Brackenridge) Holub**
Myricaceae *
*Myrica*** *gale* L.
Najadaceae *
*Najas*** *flexilis (*Willdenow) Rostkov. & Schmidt
Onagraceae
*Circaea*** *alpina* L.
Epilobium adenocaulon Lam.
***Epilobium angallidifolium* Lam.**
Epilobium davuricum Fisch. Ex Hornem.

Ophioglossaceae
***Botrychium pinnatum* H. St. John**
Orchidaceae
***Malaxis** paludosa* (L.) Sw.**
Platanthera hyperborea (L.) Lindl.
Pinaceae
Picea glauca (Moench) Voss
Plumbaginaceae *
***Armeria** maritima* ssp. *arctica* (Mill.) Willd.**
Poaceae
***Agrostis borealis* Hartm.**
Agrostis mertensii Ttrin.
Agrostis scabra Willd.
*Alopecurus** aequalis* Sobol.
***Alopecurus alpinus* J.E. Smith**
***Calamagrostis canadensis* ssp. *langsdorffi* (Michx.) Beauv.**
Calamagrostis lapponica (Michx.) Beauv.
***Calamagrostis stricta* (Wahlenb.) Hartm.**
Calamagrostis stricta ssp.*inexpansa* (Timm) Koeler
***Calamagrostis stricta* ssp. *stricta* (Timm.) Koeler**
*Deschampsia** brevifolia* R. Br.
Deschampsia caespitosa (L.) Beauv.
Elymus macrourus (Turcz.) Drobov
Elymus trachycaulus ssp. *novae-angliae* (Link) Gould ex Shinners
***Festuca baffinensis* Polunin**
Festuca brachyphylla Schultes et. Schultes fil.
Festuca saximontana Rydberg
***Festuca vivipara* (L.) Smith**
***Glyceria** borealis* Nash) Batchelder**
Glyceria grandis S. Wats.
Glyceria pulchella (Nash) K. Schum.
***Hierochloe hirta* ssp. *arctica* (Schrank) Borbas**
***Phleum** alpinum* L.**
Poa pauspicula Scribn. & Merr.
Poa pratensis ssp. *alpigena.* L.
*Puccinellia** interior* Sorens.
Polygonaceae
***Koenigia** islandica* L.**
***Polygonum amphibium* L.**
***Polygonum lapathifolium* L.**
***Polygonum pennsylvanicum* L.**
Polygonum pennsylvanicum* ssp. *oneillii L.
***Polygonum persicaria* L.**
***Polygonum viviparum* L.**
***Rumex acetosa* ssp. *alpestris* L.**
***Rumex maritimus* L.**
Polypodiaceae
*Polypodium** sibiricum* Siplivinsky
Portulacaceae
Claytonia sarmentosa C.A. Mey
***Montia fontana* L.**
Potamogetonaceae
***Potamogeton** alpinus* Balbis**
***Potamogeton epihydrus* Raf.**
***Potamogeton filiformis* Persoon**
***Potamogeton foliosus* Rafinesque**

***Potamogeton friesii* Rupr.**
***Potamogeton gramineus* L.**
***Potamogeton natans* L.**
***Potamogeton obtusifolius* Mertens & Koch**
***Potamogeton pectinatus* L.**
***Potamogeton perfoliatus* L.**
***Potamogeton perfoliatus* ssp. *richardsonii* L.**
***Potamogeton praelongus* Wulf**
***Potamogeton pusillus* L**
***Potamogeton vaginatus* Turczaninow**
***Potamogeton zosteriformis* Fern.**

Primulaceae

***Lysimachia** thyrsiflora* L.**
***Primula egaliksensis* Wormsk.**

Ranunculaceae

Caltha natans Pall.
***Caltha palustris* ssp. *arctica.* L.**
***Delphinium brachycentrum* Ledeb.**
Ranunculus cymbalaria Pursh
Ranunculus glacialis ssp. *chamissonis* L.
Ranunculus hyperboreus Rottb.
***Ranunculus macounii* Britt.**
Ranunculus pedatifidus ssp. *affinis.* Sm.
***Ranunculus trichophyllus* Chaix in Villars**

Rosaceae

Geum macrophyllum ssp. *perincisum* Willd.
***Potentilla fruticosa* L.**
***Potentilla hyparctica* Malte.**
***Potentilla virgulata* Nels.**

Rubiaceae

***Galium brandegei* Gray**

Salicaceae

Populus tremuloides Michx.
Salix alaxensis (Anderss.) Cov.
***Salix barrattiana* Hook.**
***Salix candida* Flugge**
***Salix commutata* Bebb**
***Salix fuscescens* Anders.**
Salix myrtillifolia Anders.
Salix polaris Wahlenb.
***Salix pulchra* Cham.**
Salix reticulata L.

Saxifragaceae

Ribes lacustre (Pers.) Poir
Saxifraga cernua L.
***Saxifraga foliolosa* R. Br.**
***Saxifraga rivularis* L.**
***Saxifraga spicata* D. Don**
***Saxifraga tenuis* (Wahlenb.) H.Sm.**

Scheuchzeriaceae *

***Scheuchzeria** palustris* L.**

Scrophulariaceae

***Euphrasia** subarctica* Raup.**
***Pedicularis macrodonta* Richards**
***Veronica** scutellata* L.**
Veronica wormskjoldii Roemer & J.A. Schultes

Selaginellaceae *
***Selaginella selaginoides* (L.) Link**
Sparganiaceae
Sparganium ** angustifolium* Michx.**
Sparganium minimum (Hartm.) E. Fries
Typhaceae *
*Typha** latifolia* L.
Violaceae
Viola renifolia Gray
***Viola selkirkii* Pursh ex Goldie**

Appendix B

Complete list of all vascular plant taxa vouchered for Yukon-Charley Rivers National Preserve as of 2002

Adoxaceae
- ***Adoxa moschatelliana* L.**

Alismataceae
- ***Sagittaria cuneata* Sheld.**

Apiaceae
- ***Bupleurum americanum* Coult. & Rose**
- ***Cicuta bulbifera* L.**
- ***Cicuta virosa* L.**
- ***Cnidium cnidiifolium (*Turcz.) Schischk.**
- ***Heracleum lanatum* Michx.**
- ***Podistera macounii* (Coult. & Rose) Math. & Const.**
- ***Podistera yukonensis* Math. & Const.**

Apocynaceae
- ***Apocynum androsaemifolium* L.**

Araceae
- ***Calla palustris* L.**

Aspleniaceae
- ***Asplenium viride* Huds.**

Asteraceae
- ***Achillea borealis* Bong.**
- ***Achillea millefolium* L.**
- ***Achillea sibirica* Ledeb**
- ***Antennaria alpina* (L.) Gaertn**
- ***Antennaria densifolia* Porsild**
- ***Antennaria friesiana* (Trautv.) Ekman**
- ***Antennaria friesiana* (Trautv.) Ekman ssp. *alaskana* (Malte) Hult.**
- ***Antennaria monocephala* DC.**
- ***Antennaria monocephala* DC. *ssp. monocephala***
- ***Antennaria pulcherrima* (Hook.) Greene**
- ***Antennaria rosea* Greene**
- ***Antennaria rosea* ssp. *rosea* Greene**
- ***Arnica angustifolia* Vahl.**
- ***Arnica angustifolia* ssp*. angustifolia***
- ***Arnica griscomii***
- ***Arnica griscomii* ssp. *frigida* Vahl.**
- ***Arnica lessingii* Greene**
- ***Artemisia alaskana* Rydb.**
- ***Artemisia arctica* Less.**
- ***Artemisia borealis* Pall.**
- ***Artemisia frigida* L.**
- ***Artemisia furcata* Bieb.**
- ***Artemisia hyperborea* Rydb.**
- ***Artemisia tilesii* Lerdeb.**
- ***Aster falcatus* Lindl.**
- ***Aster junciformis* Rydb.**
- ***Aster sibiricus* L.**
- ***Bidens cernua* L.**
- ***Crepis elegans* Hook.**
- ***Crepis nana* Richards.**
- ***Erigeron acris* L.**

Erigeron caespitosus **Nutt.**
Erigeron compositus **Pursh**
Erigeron elatus **Greene**
Erigeron glabellus **Nutt.**
Erigeron glabellus **ssp*. pubescens* Nutt*.***
Erigeron humilis **Graham**
Erigeron hyperboreus **Greene**
Erigeron yukonensis **Rydb.**
Leucanthemum integrifolium **(Richards.) DC.**
Packera streptanthifolius **W. A Weber & A*.* Löve**
Petastites frigidus **(L.) Fries**
Petastites sagittatus **(Banks) Gray**
Saussurea angustifolius **(Wild.) DC.**
Senecio atropurpureus **(Ledeb.) Fedtsch.**
Senecio congestus **(R. Br.) DC.**
Senecio fuscatus **(Jord. & Fourr.) Hayek**
Senecio kjellmanii **Porsild**
Senecio lugens **Richards.**
Senecio ogotorukensis **Packer**
Senecio pauciflorus **Pursh**
Senecio pauperculus **Michx*.***
Senecio resedifolius **Less.**
Senecio yukonensis **Porsild**
Solidago decumbens **Greene**
Solidago lepida **DC*.***
Solidago multiradiata **Ait.**
Tanacetum bipinnatum **(L.) Schultz-Bip. ssp*. huronense* (Nutt.) Breit.**
Taraxacum alaskanum **Rydb*.***
Taraxacum ceratophorum **(Ledeb.) DC.**
Taraxacum kamtschaticum **Dahlstedt**
Taraxacum phymatocarpum **J. Vahl.**

Balsaminaceae

Impatiens noli-tangere **L.**

Betulaceae

Alnus tenuifolia **Nutt*.***
Alnus viridis **(Chaix.) DC.**
Alnus viridis **(Vill.) Lam. & DC ssp*. fruticosa* (Rupr.) Nyman**
Betula glandulosa **Michx.**
Betula nana **L.**
Betula neoalaskana **Sarg*.***
Betula occidentalis **Hook*.***
Betula papyrifera **Marsh*.***

Boraginaceae

Cryptantha shackletteana **Higgins**
Eritrichium aretoides **(Cham.) DC.**
Mertensia paniculata **(Ait.) D. Don**
Myosotis alpestris **F.W. Schmidt**

Brassicaceae

Arabis divaricarpa **Nels*.***
Arabis hirsuta **(L.) Scop.**
Arabis holboellii **Hornem.**
Arabis kamchatica **(Fisch. ex DC.) Ledeb*.***
Braya glabella **Richards.**
Braya glabella **Richards. *ssp. purpurascens* (R. Br.) Cody**
Braya humilis **(C.A. Mey.) Robins**
Capsella bursa-pastoris **(L.) Medic**

Cardamine bellidifolia **L.**
Cardamine digitata **Richards.**
Cardamine pratensis **L.**
Cardamine purpurea **Cham. & Schlect.**
Cardamine umbellata **Greene**
Descurainia sophioides **(Fisch.) O.E. Schulz**
Draba alpina **L.**
Draba borealis **DC.**
Draba crassifolia **Graham**
Draba densifolia **Nutt. ex Torrey & A. Gray**
Draba fladnizensis **Wulf.**
Draba glabella **Pursh**
Draba lonchocarpa **Rydb.**
Draba longipes **Raup**
Draba murrayi **Muligan**
Draba nemorosa **L.**
Draba nivalis **Liljebl.**
Draba ogilviensis **Hult.**
Draba palanderiana **Kjellman**
Draba praealta **Greene**
Draba stenopetala **Trautv.**
Erysimum asperum **(Nutt.) DC. var. *angustatum* (Rydb.) Boivin**
Erysimum cheiranthoides **L.**
Erysimum inconspicuum **(S. Wats.) MacM.**
Eutremia edwardsii **R. Br.**
Halimolobus mollis **(Hook.) Rollins**
Lesquerella arctica **(Wormsk.) S. Wats.**
Lesquerella calderi **Mull. & Pors.**
Parrya nudicaulis **(L.) Regel**
Rorippa barbareaefolia **(DC.) Kitagawa**
Rorippa palustris **(L.) Besser**
Rorippa palustris **(L.) Besser *var. hispida* (Desvaux) Jonsell**
Sinapis arvensis **L.**
Smelowskia borealis **(E. L. Greene) Drury & Rollins**

Callitrichaceae

Callitriche hermaphroditica **L.**
Callitriche verna **L. emend. Lonnr.**

Campanulaceae

Campanula aurita **Greene**
Campanula lasiocarpa **Cham.**
Campanula uniflora **L.**

Caprifoliaceae

Linnaea borealis **L.**
Viburnum edule **(Michx.) Raf.**

Caryophyllaceae

Arenaria capillaris **Poir.**
Cerastium arvense **L.**
Cerastium beeringianum **Cham. & Schlecht.**
Cerastium fontanum **Baumg.**
Cerastium maximum **L.**
Melandrium affine **J. Vahl.**
Melandrium apetalum **(L.) Fenzl**
Minuartia arctica **(Stev.) Aschers. & Graebn**
Minuartia biflora **(L.) Schinzl. & Thell.**
Minuartia dawsonensis **(Britt.) Mattf.**
Minuartia elegans **(Cham. & Sclecht.) Schischk.**

Minuartia macrocarpa **(Pursh) Ostenf.**
Minuartia obtusiloba **(Rydb.) House**
Minuartia rossii **(R. Br.) Graebn.**
Minuartia rubella **(Wahlenb.) Graebn.**
Minuartia yukonensis **Hulten**
Moehringia lateriflora **(L.) Fenzl**
Silene acaulis **L.**
Silene involucrata **(Cham. & Schlecht.) Bocquet**
Silene repens **Patrin**
Silene williamsii **Britt.**
Stellaria borealis **Bigel.**
Stellaria borealis **Bigel. ssp.** ***borealis***
Stellaria calycantha **(Ledeb.) Bong.**
Stellaria crassifolia **Ehrh.**
Stellaria dicranoides **(Cham. & Schlecht.) Fenzl**
Stellaria edwardsii **R. Br.**
Stellaria laeta **Richards.**
Stellaria longfolia **Muhl.**
Stellaria longipes **Goldie**
Stellaria monantha **Hulten**
Stellaria umbellata **Turcz.**
Wilhelmsia physodes **(Fisch. ex Ser.) McNeill**

Ceratophyllaceae

Ceratophyllum demersum **L.**

Chenopodiaceae

Chenopodium album **L.**
Chenopodium capitatum **(L.) Aschers.**
Corispermum ochotense **Ignatov**

Cornaceae

Cornus canadensis **L.**
Cornus stolonifera **Michx.**

Crassulaceae

Rhodiola integrifolia **Raf.**

Cupressaceae

Juniperus communis **L.**

Cyperaceae

Carex albo-nigra **Mack.**
Carex amblyorhyncha **Krec.**
Carex aquatilis **Wahlenb.**
Carex atratiformis **Britt.**
Carex atrofusca **Schkuhr.**
Carex atrosquama **Mack.**
Carex bicolor **All.**
Carex bigelowii **Torrey ex Schweinitz**
Carex brunnescens **(Pers.) Poir**
Carex canescens **L.**
Carex capillaris **L.**
Carex capitata **Soland. in L.**
Carex chordorrhiza **Ehrh. ex. L. f.**
Carex concinna **R. Br.**
Carex crawfordii **Fern.**
Carex diandra **Schrank.**
Carex dioica **L.**
Carex dioica **L. ssp.** ***gynocrates*** **(Worms) Ost.**
Carex disperma **Dewey**
Carex eburnea **Boott**

Carex eleusinoides **Turcz.**
Carex filifolia **Nutt.**
Carex foena **Willd.**
Carex garberi **Fern.**
Carex glacialis **Mack.**
Carex holostoma **Drej.**
Carex interior **Bailey**
Carex lachenalii **Schkuhr.**
Carex laeviculmis **Meinsh**
Carex lapponica **Lang**
Carex lasiocarpa **Ehrh.**
Carex leptalea **Wahlenb.**
Carex limosa **L.**
Carex livida **Willd.**
Carex loliacea **L.**
Carex lugens **Holm.**
Carex magellanica **Lam.**
Carex magellanica **Lam. ssp.** ***irrigua*** **(Wahlenb.) Hiit.**
Carex media **R. Br.**
Carex membranacea **Hook.**
Carex microchaeta **Holm.**
Carex microchaeta **Holm. ssp.** ***microchaeta***
Carex microchaeta **Holm. ssp.** ***nesophila*** **(Holm.) Murray**
Carex misandra **R. Br.**
Carex nardina **E. Fries**
Carex obtusata **Liljeb.**
Carex oederi **Retz. ssp.** ***viridula*** **(Mich.) Kuk.**
Carex petricosa **Dewey**
Carex podocarpa **Clarke**
Carex praticola **Rydb.**
Carex rossii **Boott**
Carex rostrata **Stokes**
Carex rotundata **Wahlenb.**
Carex rupestris **All.**
Carex saxatilis **L.**
Carex scirpoidea **Michx.**
Carex supina **Willd.**
Carex supina **Willd. ssp.** ***spaniocarpa*** **(Steud.) Hult.**
Carex tenuiflora **Wahlenb.**
Carex utriculata **F. Boott**
Carex vaginata **Tausch**
Carex williamsii **Britt.**
Eleocharis acicularis **(L.) Roem & Schult.**
Eleocharis palustris **(L.) Roem. & Schult.**
Eriophorum angustifolium **Honck.**
Eriophorum brachyantherum **Trautv.**
Eriophorum callitrix **Cham.**
Eriophorum gracile **Koch.**
Eriophorum russeolum **E. Fries**
Eriophorum scheuchzeri **Hoppe**
Eriophorum vaginatum **L.**
Eriophorum viridi-carinatum **(Engelm.) Fern.**
Kobresia sibirica **Turcz.**
Kobresia simpliciuscula **(Wahlenb.) Mack.**
Scirpus validus **Vahl.**
Trichophorum alpinum **(L.) Pers.**

Trichophorum caespitosum **(L.) Hartm.**

Diapensiaceae

Diapensia lapponica **L.**

Droseraceae

Drosera anglica **Huds.**
Drosera rotundifolia **L.**

Dryopteridaceae

Cystopteris fragilis **(L.) Bernh.**
Cystopteris montana **(Lam.) Bernh.**
Dryopteris fragrans **(L.) Schott**
Gymnocarpium dryopteris **(L.) Newm.**
Gymnocarpium jessoense **(Koidz.) Koidz. ssp. *parvulum* Sarvela**
Woodsia alpina **(Bolton) S. F. Gray**
Woodsia glabella **R. Br.**
Woodsia ilvensis **(L.) R. Br.**

Elaeagnaceae

Eleagnus commutata **Bernh.**
Shepherdia canadensis **(L.) Nutt.**

Empetraceae

Empetrum nigrum **L.**

Equisetaceae

Equisetum arvense **L.**
Equisetum fluviatile **L. ampl. Ehrh.**
Equisetum palustre **L.**
Equisetum pratense **L.**
Equisetum scirpoides **Michx.**
Equisetum sylvaticum **L.**
Equisetum variegatum **Schleich.**

Ericaceae

Andromeda polifolia **L.**
Arctostaphylos alpina **(L.) Spreng.**
Arctostaphylos rubra **(Rehd. & Wilson) Fern.**
Arctostaphylos uva-ursi **(L.) Spreng.**
Cassiope tetragona **(L.) D. Don**
Chamaedaphne calyculata **(L.) Moench**
Ledum decumbens **(Ait.) Small**
Ledum groenlandicum **Oeder**
Ledum palustre **L.**
Loiseleuria procumbens **(L.) Desv.**
Oxycoccus microcarpus **Turcz.**
Rhododendron lapponicum **(L.) Wahlenb.**
Vaccinium uliginosum **L.**
Vaccinium vitis-idaea **L.**

Fabaceae

Astragalus aboriginum **Richards.**
Astragalus agrestis **Douglas. ex G. Don**
Astragalus alpinus **L.**
Astragalus bodinii **Sheld.**
Astragalus eucosmus **Robins.**
Astragalus robbinsii **(Oakes) Gray**
Astragalus umbellatus **Bunge**
Astragalus williamsii **Rydb.**
Hedysarum alpinum **L.**
Hedysarum mackenzii **Richards.**
Lupinus arcticus **S. Wats.**
Oxytropis arctica **R. Br.**

Oxytropis borealis DC.
***Oxytropis borealis* var. *borealis* DC.**
***Oxytropis campestris* (L.) DC.**
***Oxytropis campestris* (L.) DC. ssp. *jordalii* (Pors.) Hult.**
***Oxytropis deflexa* (Pall.) DC.**
***Oxytropis huddelsonii* Pors.**
Oxytropis maydelliana Trautv.
Oxytropis mertensiana Turcz.
***Oxytropis nigrescens* (Pall.) Fisch.**
***Oxytropis scammaniana* Hulten**
***Oxytropis splendens* Dougl.**
***Trifolium repens* L.**

Fumariaceae
***Corydalis pauciflora* (Steph.) Pers.**
***Corydalis sempervirens* (L.) Pers.**

Gentianaceae
***Gentiana algida* Pall.**
***Gentiana glauca* Pall.**
***Gentiana prostrata* Haenke**
***Gentianella propinqua* (Richards.) J. Gillett**
***Menyanthes trifoliata* L.**

Haloragaceae
***Hippuris montana* Ledeb.**
***Hippuris vulgaris* L.**
***Myriophyllum sibiricum* Komarov**
***Myriophyllum verticillatum* L.**

Hydrophyllaceae
***Phacelia mollis* Macbr.**
***Phacelia sericea* (Grah.) A. Gray**

Juncaceae
***Juncus alpinus* Vill.**
***Juncus arcticus* Willd.**
***Juncus biglumis* L.**
***Juncus bufonius* L.**
***Juncus castaneus* Sm.**
***Juncus filiformis* L.**
***Juncus triglumis* L.**
***Luzula arctica* Blytt**
***Luzula arcuata* (Wahlenb.) Sw.**
***Luzula arcuata* (Wahlenb.) Sw ssp. *unalaschensis* (Buchenau) Hult**
***Luzula confusa* Lindeb.**
***Luzula multiflora* (Retz.) Lej.**
***Luzula parviflora* (Ehrh.) Desv.**
***Luzula rufescens* Fisch. ex E. Meyer**
***Luzula spicata* (L.) DC.**
***Luzula tundricola* Gorodk.**
***Luzula wahlenbergii* Rupr.**

Juncaginaceae
***Triglochin maritimum* L.**
***Triglochin palustris* L.**

Lamiaceae
***Dracocephalum parviflorum* Nutt.**
***Lycopus uniflorus* Michx.**
***Scutellaria galericulata* L.**

Lemnaceae
- ***Lemna minor* L.**

Lentibulariaceae
- ***Pinguicula villosa* L.**
- ***Pinguicula vulgaris* L.**
- ***Utricularia intermedia* Hayne**
- ***Utricularia minor* L.**
- ***Utricularia vulgaris* L.**

Liliaceae
- ***Allium schoenoprasum* (L.) Hartm.**
- ***Lloydia serotina* (L.) Rchb.**
- ***Smilacina stellata (*L.) Desf.**
- ***Tofieldia coccinea* Richards.**
- ***Tofieldia glutinosa* (Michx.) Pers.**
- ***Tofieldia pusilla* (Michx.) Pers.**
- ***Zygadenus elegans* Pursh**

Linaceae
- ***Linum lewisii* Pursh.**
- ***Linum perenne* L.**

Lycopodiaceae
- ***Diphasiastrum alpinum* (L.) Holub**
- ***Diphasiastrum complanatum* (L.) Holub**
- ***Huperzia haleakalae* (Brackenridge) Holub**
- ***Lycopodium annotinum* L.**
- ***Lycopodium clavatum* L.**
- ***Lycopodium dendroideum* Michx.**

Myricaceae
- ***Myrica gale* L.**

Najadaceae
- ***Najas flexilis (*Willd.) Rostkov. & Schmidt**

Nymphaceae
- ***Nuphar polysepalum* Engelm.**
- ***Nymphaea tetragona* Georgi.**

Onagraceae
- ***Circaea alpina* L.**
- ***Epilobium adenocaulon* Lam.**
- ***Epilobium angallidifolium* Lam.**
- ***Epilobium angustifolium* L.**
- ***Epilobium davuricum* Fisch. ex Hornem.**
- ***Epilobium hornemannii* Rchb.**
- ***Epilobium latifolium* L.**
- ***Epilobium palustre* L.**

Ophioglossaceae
- ***Botrychium boreale* (E. Fries) Milde**
- ***Botrychium lunaria* (Linneaus) Swartz**
- ***Botrychium pinnatum* H. St. John**

Orchidaceae
- ***Calypso bulbosa* (L.) Rchb. f.**
- ***Corallorohiza trifida* Chatelain**
- ***Cypripedium gutattum* Sw.**
- ***Cypripedium passerinum* Richards.**
- ***Goodyera repens* (L.) R. Br.**
- ***Listera borealis* Morong**
- ***Malaxis paludosa* (L.) Sw.**
- ***Platanthera hyperborea* (L.) Lindl.**
- ***Platanthera obtusata* (Pursh) Lindl.**

Spiranthes romanzoffiana **Cham.**

Orobanchaceae

Boschniakia rossica **(Cham. & Schlecht.) Fedtsch.**
Orobanche fasciculate **Nutt.**

Papaveraceae

Papaver lapponicum **(Tolm.) Nordh.**
Papaver macounii **Greene**
Papaver mcconnellii **Hult.**
Papaver nudicaule **L.**
Papaver radicatum **Rottb.**

Pinaceae

Picea glauca **(Moench) Voss**

Plantaginaceae

Plantago canescens **Adams**
Plantago major **L.**

Plumbaginaceae

Armeria maritima **(Mill.) Willd. ssp.** ***arctica*** **(Cham.) Hult.**

Poaceae

Agrostis borealis **Hartm.**
Agrostis mertensii **Trin.**
Agrostis scabra **Willd.**
Alopecurus aequalis **Sobol.**
Alopecurus alpinus **J.E. Smith**
Arctagrostis latifolia **(R. Br.) Griseb.**
Arctophila fulva **(Trin.) Anderss .**
Beckmania syzigachne **(Steud.) Fern.**
Bromus inermis **Leyss.**
Bromus inermis **Leyss. ssp.** ***pumpellianus (*****Scrib.) Wag.**
Bromus inermis **Leyss. ssp.** ***pumpellianus (*****Scrib.) Wag. var.** ***arcticus*** **(Shear) Wag.**
Calamagrostis canadensis (Michx.) Beauv.
Calamagrostis canadensis **ssp.** ***langsdorffi*** **(Michx.) Beauv.**
Calamagrostis lapponica **(Michx.) Beauv.**
Calamagrostis purpurascens **R. Br.**
Calamagrostis stricta **(Wahlenb.) Hartm.**
Calamagrostis stricta **ssp.** ***inexpansa*** **(Timm) Koeler**
Calamagrostis stricta **ssp.** ***stricta*** **(Timm.) Koeler**
Deschampsia brevifolia **R. Br.**
Deschampsia caespitosa **(L.) Beauv.**
Elymus alaskanus **(S. & M.) A. Love**
Elymus alaskanus **(S. & M.) A. Love ssp.** ***alaskanus***
Elymus alaskanus **(S. & M.) A. Love ssp.** ***hyperarcticus*** **(Pol.) A. & D. Love**
Elymus macrourus **(Turcz.) Drobov**
Elymus spicatus **(Pursh) Gould**
Elymus trachycaulus **(Link) Gould ex Shinners**
Elymus trachcaulus **(Link) Gould ex Shin. ssp.** ***novae-angliae*** **(Scribn.) Tzvel.**
Festuca altaica **Trin**
Festuca baffinensis **Polunin**
Festuca brachyphylla **Schultes et. Schultes fil.**
Festuca brevissima **Jurtzev**
Festuca lenensis **Dobov**
Festuca rubra **L.**
Festuca saximontana **Rydberg**
Festuca vivipara **(L.) Smith**
Glyceria borealis **(Nash) Batchelder**
Glyceria grandis **S. Wats.**
Glyceria pulchella **(Nash) K. Schum.**

Hierochloe alpina **(Sw.) Roem. & Schult.**
Hierochloe hirta **ssp*. arctica*** **(Schrank) Borbas**
Hierochloe odorata **(L.) Wahlenb.**
Hordeum jubatum **L.**
Phleum alpinum **L.**
Poa alpina **L.**
Poa arctica **R. Br.**
Poa glauca **M. Vahl.**
Poa palustris **L.**
Poa pauspicula **Scribn. & Merr.**
Poa porsildii **Gjaerevoll**
Poa pratensis **L.**
Poa pratensis **L. ssp*. alpigena*** **(Fries. ex Blytt) Hiitonen**
Puccinellia interior **Sorens*.***
Trisetum spicatum **(L.) Richter**

Polemoniaceae

Phlox hoodii **Richards.**
Phlox sibirica **L.**
Polemonium acutiflorum **Willd.**
Polemonium boreale **Adams**
Polemonium pulcherrimum **Hook.**

Polygonaceae

Eriogonum flavum **Nutt.**
Koenigia islandica **L*.***
Oxyria digyna **(L.) Hill**
Polygonum alaskanum **(Small) Wight**
Polygonum amphibium **L*.***
Polygonum aviculare **L*.***
Polygonum bistorta **L.**
Polygonum bistorta **L. ssp. *plumosum*** **(Small) Boivin.**
Polygonum lapathifolium **L*.***
Polygonum pennsylvanicum **L*.***
Polygonum pennsylvanicum **ssp. *oneillii*** **L*.***
Polygonum persicaria **L*.***
Polygonum viviparum **L.**
Rumex acetosa **L.**
Rumex acetosa **ssp*. alpestris*** **L*.***
Rumex arcticus **Trautv.**
Rumex maritimus **L*.***
Rumex sibiricus **Hult.**

Polypodiaceae

Polypodium sibiricum **Siplivinsky**

Portulacaceae

Claytonia sarmentosa **C.A. Mey**
Claytonia scammaniana **Hulten**
Claytonia tuberosa **Pall.**
Montia bostockii **(A.E. Porsild) Welsh**
Montia fontana **L*.***

Potamogetonaceae

Potamogeton alpinus **Balbis**
Potamogeton epihydrus **Raf.**
Potamogeton filiformis **Persoon**
Potamogeton foliosus **Rafinesque**
Potamogeton friesii **Rupr.**
Potamogeton gramineus **L*.***
Potamogeton natans **L*.***

Potamogeton obtusifolius **Mertens & Koch**
Potamogeton pectinatus **L.**
Potamogeton perfoliatus **L.**
Potamogeton perfoliatus **L. ssp.** ***richardsonii*** **(Bennett) Hult.**
Potamogeton praelongus **Wulf**
Potamogeton pusillus **L.**
Potamogeton vaginatus **Turczaninow**
Potamogeton zosteriformis **Fern.**

Primulaceae

Androsace chamaejasme **Host**
Androsace septentrionalis **L.**
Dodecatheon frigidum **Cham. & Schlecht.**
Dodecatheon pulchellum **(Raf.) Merr.**
Douglasia arctica **Hook.**
Douglasia gormanii **Const.**
Lysimachia thyrsiflora **L.**
Primula egaliksensis **Wormsk.**
Primula eximia **Greene**
Primula mistassinica **Michx.**
Trientalis europaea **L.**

Pteridaceae

Cryptogramma stelleri **R. Br.**

Pyrolaceae

Moneses uniflora **(L.) Gray**
Orthilia secunda **(L.) House**
Pyrola asarifolia **Michx.**
Pyrola chlorantha **Sw.**
Pyrola grandiflora **Radius**
Pyrola minor **L.**

Ranunculaceae

Aconitum delphinifolium **DC.**
Acteae rubra **(Ait.) Willd.**
Anemone drummondii **S. Wats.**
Anemone multiceps **(Greene) Standl.**
Anemone narcissiflora **L.**
Anemone parviflora **Michx.**
Anemone richardsonii **Hook.**
Caltha natans **Pall.**
Caltha palustris **L.**
Caltha palustris **L. ssp.** ***arctica. (*****R. Br.) Hult.**
Delphinium brachycentrum **Ledeb.**
Delphinium glaucum **S. Wats.**
Pulsatilla patens **(L.) Mill.**
Ranunculus cymbalaria **Pursh**
Ranunculus glacialis **L. ssp.** ***chamissonis*** **(Schlecht.) Hult.**
Ranunculus gmelinii **DC.**
Ranunculus hyperboreus **Rottb.**
Ranunculus lapponicus **L.**
Ranunculus macounii **Britt.**
Ranunculus nivalis **L.**
Ranunculus pedatifidus **Sm. ssp.** ***affinis*** **(R. Br.) Hult**
Ranunculus pensylvanicus **L. f.**
Ranunculus pygmaeus **Wahlenb.**
Ranunculus sceleratus **L.**
Ranunculus sulphureus **Soland.**
Ranunculus trichophyllus **Chaix in Villars**

Ranunculus turneri **Greene**
Thalictrum alpinum **L.**
Thalictrum sparsiflorum **Turcz.**

Rosaceae

Amelanchier alnifolia **(Nutt.) Nutt.**
Chamaerhodos erecta **(L.) Bunge**
Chamaerhodos erecta **(L.) Bunge ssp.** ***nuttallii*** **(Torr. & Gray) Hult.**
Comarum palustre **L.**
Dryas alaskensis **Pors.**
Dryas drummondii **Richards.**
Dryas integrifolia **M. Vahl.**
Dryas integrifolia **M. Vahl. ssp.** ***sylvatica*** **(Hultén) Hultén**
Dryas octopetala **L.**
Fragaria virginiana **Duchesne**
Geum glaciale **Adams ex Fisch.**
Geum macrophyllum **Willd.**
Geum macrophyllum **ssp.** ***perincisum*** **Willd.**
Geum rossii **(R. Br.) Ser.**
Potentilla anserina **L.**
Potentilla biflora **Willd.**
Potentilla egedii **Wormsk.**
Potentilla elegans **Cham. & Schlecht.**
Potentilla fruticosa **L.**
Potentilla hookeriana **Lehm.**
Potentilla hyparctica **Malte.**
Potentilla nivea **L.**
Potentilla norvegica **L.**
Potentilla pennsylvanica **L.**
Potentilla uniflora **Ledeb.**
Potentilla virgulata **Nels.**
Rosa acicularis **Lindl.**
Rosa woodsii **Lindl.**
Rubus arcticus **L.**
Rubus chamaemorus **L.**
Rubus idaeus **L.**
Sanguisorba officinalis **L.**
Sibbaldia procumbens **L.**
Spiraea stevenii **(Schneid.) Rydb.**

Rubiaceae

Galium boreale **L.**
Galium brandegei **Gray**
Galium trifidum **L.**
Galium trifidum **L. ssp.** ***trifidum***

Salicaceae

Populus balsamifera **L.**
Populus tremuloides **Michx.**
Salix alaxensis **(Anderss.) Cov.**
Salix arbusculoides **Anderss.**
Salix arctica **Pall.**
Salix barclayi **Anderss.**
Salix barrattiana **Hook.**
Salix bebbiana **Sarg.**
Salix candida **Flugge**
Salix chamissonis **Anderss.**
Salix commutata **Bebb**
Salix fuscescens **Anders.**

Salix glauca **L.**
Salix hastata **L.**
Salix interior **Rowlee**
Salix lucida **Muhl.**
Salix lucida **Muhl. ssp.** ***lasiandra*** **(Benth.) E. Murr**
Salix myrtillifolia **Anders.**
Salix niphoclada **Rydb.**
Salix phlebophylla **Anders.**
Salix polaris **Wahlenb.**
Salix pseudomonticola **Ball**
Salix pseudomyrsinites **Anderss.**
Salix pulchra **Cham.**
Salix reticulata **L.**
Salix richardsonii **Hook.**
Salix rotundifolia **Trautv.**

Santalaceae

Geocaulon lividum **(Richards.) Fern.**

Saxifragaceae

Boykinia richardsonii **(Hook.) Gray**
Chrysosplenium tetandrum **(Lund) T. Fries**
Chrysosplenium wrightii **Fr. & Sav.**
Parnassia kotzebuei **Cham. & Schlecht.**
Parnassia palustris **L.**
Ribes glandulosum **Grauer**
Ribes hudsonianum **Richards.**
Ribes lacustre **(Pers.) Poir**
Ribes triste **Pall.**
Saxifraga bronchialis **L.**
Saxifraga caespitosa **L.**
Saxifraga cernua **L.**
Saxifraga davurica **Willd.**
Saxifraga eschscholtzii **Sternb.**
Saxifraga flagellaris **Willd.**
Saxifraga foliolosa **R. Br.**
Saxifraga hieracifolia **Waldst. & Kit.**
Saxifraga hirculus **L.**
Saxifraga nelsoniana **D. Don**
Saxifraga nivalis **L.**
Saxifraga oppositifolia **L.**
Saxifraga radiata **Small**
Saxifraga reflexa **Hook.**
Saxifraga rivularis **L.**
Saxifraga serpyllifolia **Pursh**
Saxifraga spicata **D. Don**
Saxifraga tenuis **(Wahlenb.) H.Sm.**
Saxifraga tricuspidata **Rottb.**

Scheuchzeriaceae

Scheuchzeria palustris **L.**

Scrophulariaceae

Castilleja caudata **(Pennell) Rebr.**
Castilleja elegans **Malte**
Castilleja hyperborea **Pennell**
Castilleja raupii **Pennell**
Euphrasia subarctica **Raup.**
Lagotis glauca **Gaertn.**
Pedicularis capitata **Adams**

Pedicularis interior **(Hult.) Molau & D.F. Murray**
Pedicularis labradorica **Wirsing**
Pedicularis lanata **Cham. & Schlecht**
Pedicularis langsdorffi **Fisch. ex. Stev.**
Pedicularis macrodonta **Richards**
Pedicularis oederi **M. Vahl.**
Pedicularis sudetica **Willd.**
Pedicularis verticillata **L.**
Penstemon gormani **Greene**
Synthyris borealis **Pennell**
Veronica scutellata **L.**
Veronica wormskjoldii **Roemer & J.A. Schultes**

Selaginellaceae
Selaginella selaginoides **(L.) Link**
Selaginella sibirica **(Milde) Hieron**

Sparganiaceae
Sparganium angustifolium **Michx.**
Sparganium minimum **(Hartm.) E. Fries**

Typhaceae
Typha latifolia **L.**

Valerianaceae
Valeriana capitata **Pall.**

Violaceae
Viola biflora **L.**
Viola epipsila **Ledeb.**
Viola epipsila **Ledeb. ssp.** ***repens*** **(Turcz.) Becker**
Viola renifolia **Gray**
Viola selkirkii **Pursh ex Goldie**

Appendix C. Notable collections from 2002 vascular plant inventory in Yukon-Charley Rivers National Preserve

Taxon	Locality	Collection Site	Collectors	Collection Number	Date	Determination
Alismataceae						
SAGITTARIA CUNEATA Sheld.	Large lake on N bank of Yukon R, 4.3 km upstream of Kandik R mouth	65º 21.36' N 142º 25.60' W	M. B. Cook & A. Larsen	02-562	04 08 2002	
Apiaceae						
CICUTA BULBIFERA L.	Large bog complex along Yukon R corridor 5.2 km SW of VABM Wedge, Yukon R	65º 22.823' N 143º 27.269' W	A. Larsen & A. Batten	02-2339	22 07 2002	
CICUTA BULBIFERA L.	Large bog system on N bank of Yukon R, 1.8 km downstream of mouth of Kandik R, Yukon R	65º 23.370' N 142º 31.992' W	A. Larsen & A. Batten	02-2402	24 07 2002	
CICUTA BULBIFERA L.	Wetland complex along N bank of Yukon R, opposite Tacoma Bluff 2.3 km NW of VABM Never	65º 28.954' N 143º 36.482' W	A. Larsen & M. B. Cook	02-2438	02 08 2002	
CICUTA BULBIFERA L.	Oxbow and bog within Andrew Cr Flats adjacent to Yukon R, 0.9 km NW of mouth of Andrew Cr	65º 22.359' N 143º 02.224' W	A. Larsen & M. B. Cook	02-2478	03 08 2002	
CICUTA BULBIFERA L.	Wetlands along N bank of Yukon R, opposite Tacoma Bluff, 2.3 km NW of VABM Never	65º 28.954' N 143º 36.482' W	M. B. Cook & A. Larsen	02-484	02 08 2002	
HERACLEUM LANATUM Michx.	Mt. Casca, Ogilvie Mts	65º 20.34' N 141º 03.19' W	M. B. Cook & B. Bennett	02-091	26 06 2002	
Asteraceae						
ANTENNARIA FRIESIANA (Trautv.) Ekman ssp. ALASKANA (Malte) Hult.	N-S trending alpine ridge in middle fork, 20 km E of VABM Edge	64º 36.99' N 143º 41.38' W	C. Roland	5709	18 07 2002	conf. A. Batten (ALA) 01/2003
ERIGERON HYPERBOREUS Greene	Subalpine peak between Hard Luck Cr. and the Yukon R., 7 km NW of VABM Hi-Yu, Ogilvie Mts	65º 07.141' N 141º 13.272' W	C. Roland	5483	20 06 2002	conf. A. Batten (ALA) 01/2003
SENECIO YUKONENSIS Pors.	Extreme headwaters of Alder Creek at divide to Yukon Fork of South Fork Birch Cr, 14.1 km W of Mt. Kathryn, Yukon-Tanana Uplands	65º 12.240' N 143º 49.822' W	A. Larsen & B. Bennett	02-2020	08 07 2002	
SENECIO YUKONENSIS Pors.	S facing slope at North Ogilvie Base Camp, ridge between Tindir and Waterfall Creeks, 4.9 km S of VABM Casca, Ogilvie Mts	65º 18.209' N 141º 04.678' W	A. Larsen & D. Person	02-1484	25 06 2002	

Taxon	Locality	Collection Site	Collectors	Collection Number	Date	Determination
SENECIO YUKONENSIS Pors.	Ridge 2.5 km due E of Mt. Sorenson, Yukon-Tanana Uplands	64º 59.525' N 142º 53.690' W	A. Larsen & D. Person	02-1656	30 06 2002	
SENECIO YUKONENSIS Pors.	Alpine plateau 3.8 km NW of VABM Chen, Yukon-Tanana Uplands	64º 52.145' N 142º 55.859' W	A. Larsen & D. Person	02-1697	01 07 2002	
SENECIO YUKONENSIS Pors.	Mountains dividing the Goodpaster and Charley R drainages, 17.5 km N of VABM Paster, Yukon-Tanana Uplands	64º 32.385' N 143º 42.126' W	A. Larsen, B. Bennett & M. Cook	02-1849	04 07 2002	
SENECIO YUKONENSIS Pors.	Ridge on S boundary of Preserve, 9.3 km E/SE of VABM Edge	64º 35.22' N 143º 55.73' W	C. Roland	5699	18 07 2002	conf. A. Batten (ALA) 01/2003
SENECIO YUKONENSIS Pors.	Peak on ridge dividing E and Middle forks	64º 38.44' N 143º 40.53' W	C. Roland	5654	16 07 2002	conf. A. Batten (ALA) 01/2003
SENECIO YUKONENSIS Pors.	Alpine plateau on upper Copper Creek	64º 48.16' N 143º 53.83' W	M. B. Cook & B. Bennett	02-258	01 07 2002	
SENECIO YUKONENSIS Pors.	Peak 3738, Ogilvie Mts	65º 23.16' N 141º 07.34' W	M. B. Cook & B. Bennett	02-016	25 06 2002	
SENECIO YUKONENSIS Pors.	Mt. Casca, Ogilvie Mts	65º 20.34' N 141º 03.19' W	M. B. Cook & B. Bennett	02-076	26 06 2002	
SENECIO YUKONENSIS Pors.	Alpine basin at head of Charley R	64º 44.26' N 143º 50.75' W	M. B. Cook & C. Roland	02-357B	17 07 2002	
SENECIO YUKONENSIS Pors.	Upper Charley R	64º 36.57' N 143º 41.88' W	M. B. Cook & C. Roland	02-431	18 07 2002	
Balsaminaceae						
IMPATIENS NOLI-TANGERE L.	Gravel bar along Kandik R, 1.5 km upstream of mouth of Judge Cr	65º 27.189' N 142º 13.137' W	A. Larsen & M. B. Cook	02-2587a	05 08 2002	det. C. Parker (ALA) 02/2003
Brassicaceae						
CARDAMINE DIGITATA Richards.	Stream on S side of Yukon 4.9 km downstream of Woodchopper Roadhouse, Yukon R	65º 21.359' N 143º 23.965' W	A. Larsen & A. Batten	02-1288	13 06 2002	conf. C. Parker (ALA) 02/2003
DRABA MURRAYI G.A. Mulligan	Road between Coal Cr Camp and Woodchopper mine, Yukon-Tanana Uplands	65º 18.148' N 143º 22.856' W	A. Larsen & A. Batten	02-2243	21 07 2002	det. C. Parker (ALA) 02/2003
DRABA MURRAYI G.A. Mulligan	Subalpine peak between Hard Luck CR and the Yukon R, 7 km NW of VABM Hi-Yu, Ogilvie Mts	65º 07.141' N 141º 13.272' W	C. Roland	5485A	20 06 2002	det. C. Parker (ALA) 01/2003
DRABA MURRAYI G.A. Mulligan	Ridge trending S from summit of Squaw Pk, Ogilvie Mts	65º 02.736' N 141º 01.473' W	C. Roland, J. Brodie, E. Groth	5410	18 06 2002	conf. C. Parker (ALA) 01/2003

Taxon	Locality	Collection Site	Collectors	Collection Number	Date	Determination
DRABA MURRAYI G.A. Mulligan	Ridge trending S from summit of Squaw Pk, Ogilvie Mts	65º 02.736' N 141º 01.473' W	C. Roland, J. Brodie, E. Groth	5413	18 06 2002	conf. A. Batten (ALA) 01/2003
DRABA MURRAYI G.A. Mulligan	Upper Hard Luck Creek drainage - slope 5 km NW of Nimrod Pk., Ogilvie Mts	65º 06.329' N 141º 07.776' W	C. Roland, J. Brodie, E. Groth	5453	19 06 2002	conf. C. Parker (ALA) 01/2003
DRABA OGILVIENSIS Hult.	Lower portion of ridge between Tindir and Waterfall Creeks, 4.9 km S of VABM Casca, Ogilvie Mts	65º 12.13' N 141º 04.678' W	A. Larsen & D. Person	02-1445	24 06 2002	
DRABA OGILVIENSIS Hult.	Mt. Casca, Ogilvie Mts	65º 20.34' N 141º 03.19' W	M. B. Cook & B. Bennett	02-053	26 06 2002	
HALIMOLOBUS MOLLIS (Hook.) Rollins	Dry subalpine ridge in rock crevices and open, nitrogen-rich soil around rodent burrows on rock outcrop.	64º 47.657' N 143º 30.187' W	C. Roland	5686	17 07 2002	conf. C. Parker (ALA) 01/2003
SINAPIS ARVENSIS L.	Beaver pond	65º 17.84' N 143º 10.30' W	M. B. Cook	02-465	19 07 2002	
Campanulaceae						
CAMPANULA AURITA Greene	Ridge 2.5 km due E of Mt. Sorenson, Yukon-Tanana Uplands	64º 59.525' N 142º 53.690' W	A. Larsen & D. Person	02-2375	23 07 2002	
Caryophyllaceae						
SILENE WILLIAMSII Britt. (Britt.) Hult. comb. nov.	Large alpine plateau on N flank of Mt. Kathryn, Yukon-Tanana Uplands	65º 12.13' N 143º 32.19' W	A. Larsen, B. Bennett, M. Cook	02-1773	02 07 2002	conf. C. Parker (ALA) 02/2003
SILENE WILLIAMSII Britt. (Britt.) Hult. comb. nov.	Bluff on Copper Creek	64º 50.42' N 143º 14.24' W	M. B. Cook & B. Bennett	02-236A	01 07 2002	
SILENE WILLIAMSII Britt. (Britt.) Hult. comb. nov.	S-facing bluff on upper Charley R	64º 47.657' N 143º 30.187' W	M. B. Cook & C. Roland	02-367	17 07 2002	
SILENE WILLIAMSII Britt. (Britt.) Hult. comb. nov.	Coal Creek, S-facing knoll to NW of main cabins	65º 18.44' N 143º 10.979'W	M. B. Cook	02-471	20 07 2002	det. C. Parker (ALA) 05/2004
Ceratophyllaceae						
CERATOPHYLLUM DEMERSUM L.	Vic. of small lake along N bank of Yukon R, 6.7 km W of VABM Witch	65º 19.225' N 142º 03.772' W	A. Larsen & M. B. Cook	02-2548	05 08 2002	

Taxon	Locality	Collection Site	Collectors	Collection Number	Date	Determination
CERATOPHYLLUM DEMERSUM L.	Vic. of small pond and bog complex on S bank of Yukon R, opposite Biederman Bluff, Yukon R	65º 22.744' N 142º 36.008' W	A. Larsen & M. B. Cook	02-2630	06 08 2002	
CERATOPHYLLUM DEMERSUM L.	Small pond and bog complex on S bank of Yukon R	65º 22.75' N 142º 36.02' W	M. B. Cook & A. Larsen	02-691	06 08 2002	
Cyperaceae						
CAREX HOLOSTOMA Drej.	Stream corridor and ponds along the Diamond Fork of the Seventymile R, 5.9 km N of VABM Chen, Yukon-Tanana Uplands	64º 53.604' N 142º 48.677' W	A. Larsen	02-2200	11 07 2002	conf. C. Parker (ALA) 02/2003
CAREX HOLOSTOMA Drej.	Upper Crescent Creek	64º 52.482' N 143º 58.917' W	M. B. Cook & C. Roland	02-304	15 07 2002	conf. C. Parker (ALA) 03/2003
CAREX INTERIOR Bailey	Large bog complex along Yukon R corridor 5.2 km SW of VABM Wedge	65º 22.823' N 143º 27.269' W	A. Larsen & A. Batten	02-2345	22 07 2002	det. C. Parker (ALA) 02/2003
CAREX LAPPONICA Lang	Vic. of 2 ponds adjacent to N branch of the Three Fingers on the Charley R, Yukon-Tanana Uplands	64º 38.119' N 143º 06.144' W	A. Larsen	02-2170	10 07 2002	det. C. Parker (ALA) 02/2003
CAREX VIRIDULA Michx.	Floodplain, 14 km S of VABM Crescent	64º 52.482' N 143º 58.917' W	C. Roland	5617	15 07 2002	conf. C. Parker (ALA) 01/2003
Fabaceae						
ASTRAGALUS WILLIAMSII Rydb.	Large forested island in Yukon R 3.6 km downstream of VABM Reef	65º 03.36' N 141º 22.13' W	A. Larsen & A. Batten	02-1231	10 06 2002	conf. C. Parker (ALA) 02/2003
OXYTROPIS ARCTICA R. Br.	Three Castle Mt., Ogilvie Mts	65º 11.879' N 141º 10.611' W	A. Larsen & D. Person	02-1512	25 06 2002	det. C. Parker (ALA) 02/2003
OXYTROPIS ARCTICA R. Br.	S facing slope at North Ogilvie Base Camp, ridge between Tindir and Waterfall Creeks, 4.9 km S of VABM Casca, Ogilvie Mts	65º 18.209' N 141º 04.678' W	A. Larsen & D. Person	02-1482b	25 06 2002	det. C. Parker (ALA) 02/2003
OXYTROPIS ARCTICA R. Br.	Vic. Nimrod Pk., Ogilvie Mts	65º 04.516' N 141º 06.124' W	C. Roland, J. Brodie, E. Groth	5345	17 06 2002	det. A. Batten (ALA) 01/2003
OXYTROPIS ARCTICA R. Br.	Ridge trending S from summit of Squaw Pk., Ogilvie Mts	65º 02.736' N 141º 01.473' W	C. Roland, J. Brodie, E. Groth	5416	18 06 2002	det. A. Batten (ALA) 01/2003
OXYTROPIS HUDDELSONII Pors.	Copper Hills, 1.5 km S of VABM Copper, Yukon-Tanana Uplands	64º 39.800' N 143º 16.381' W	A. Larsen	02-2152	10 07 2002	conf. C. Parker (ALA) 02/2003

Taxon	Locality	Collection Site	Collectors	Collection Number	Date	Determination
OXYTROPIS HUDDELSONII Pors.	Mountains dividing the Goodpaster and Charley R drainages, 17.5 km N of VABM Paster, Yukon-Tanana Uplands	64º 32.385' N 143º 42.126' W	A. Larsen, B. Bennett & M. Cook	02-1993b	07 07 2002	conf. C. Parker (ALA) 02/2003
OXYTROPIS HUDDELSONII Pors.	Exposed gravel morainal feature, 13.6 km E/NE of VABM Edge	64º 37.34' N 143º 49.69' W	C. Roland	5708	18 07 2002	conf. C. Parker (ALA) 01/2003
OXYTROPIS HUDDELSONII Pors.	N-S trending alpine ridge in middle fork, 20 km E of VABM Edge	64º 36.99' N 143º 41.38' W	C. Roland	5713	18 07 2002	conf. C. Parker (ALA) 01/2003
OXYTROPIS HUDDELSONII Pors.	Upper Charley R	64º 36.99' N 143º 41.38' W	M. B. Cook & C. Roland	02-426	18 07 2002	conf. C. Parker (ALA) 03/2002
OXYTROPIS SCAMMANIANA Hult.	Copper Hills, 1.5 km S of VABM Copper, Yukon-Tanana Uplands	64º 39.800' N 143º 16.381' W	A. Larsen	02-2094	09 07 2002	
OXYTROPIS SCAMMANIANA Hult.	Extreme headwaters of Alder Creek at divide to Yukon Fork of South Fork Birch Cr, 14.1 km W of Mt. Kathryn, Yukon-Tanana Uplands	65º 12.240' N 143º 49.822' W	A. Larsen & B. Bennett	02-2038	08 07 2002	conf. C. Parker (ALA) 02/2003
OXYTROPIS SCAMMANIANA Hult.	S facing slope at North Ogilvie Base Camp, ridge between Tindir and Waterfall Creeks, 4.9 km S of VABM Casca, Ogilvie Mts	65º 18.209' N 141º 04.678' W	A. Larsen & D. Person	02-1479	25 06 2002	
OXYTROPIS SCAMMANIANA Hult.	Alpine plateau 3.8 km NW of VABM Chen, Yukon-Tanana Uplands	64º 52.145' N 142º 55.859' W	A. Larsen & D. Person	02-1691	01 07 2002	
OXYTROPIS SCAMMANIANA Hult.	Mountains dividing the Goodpaster and Charley R drainages, 17.5 km N of VABM Paster, Yukon-Tanana Uplands	64º 32.385' N 143º 42.126' W	A. Larsen, B. Bennett & M. Cook	02-1891	04 07 2002	
OXYTROPIS SCAMMANIANA Hult.	Mountains dividing the Goodpaster and Charley R drainages, 17.5 km N of VABM Paster, Yukon-Tanana Uplands	64º 32.385' N 143º 42.126' W	A. Larsen, B. Bennett & M. Cook	02-1993d	07 07 2002	
OXYTROPIS SCAMMANIANA Hult.	Ridge dividing upper Essie Cr. from Seventymile R drainage, 6.6 km SW of Mt. Sorensen, Yukon-Tanana Uplands	64º 57.988' N 143º 05.144' W	A. Larsen, C. Roland & A. Batten	02-1435	20 06 2002	
OXYTROPIS SCAMMANIANA Hult.	E-W trending ridge	65º 16.55' N 141º 07.77' W	M. B. Cook & B. Bennett	02-025	25 06 2002	
OXYTROPIS SCAMMANIANA Hult.	Upper Charley R	64º 36.99' N 143º 41.38' W	M. B. Cook & C. Roland	02-427	18 07 2002	
Haloragaceae						

Taxon	Locality	Collection Site	Collectors	Collection Number	Date	Determination
HIPPURIS MONTANA Ledeb.	Wetlands along N bank of Yukon R, opposite Tacoma Bluff, 2.3 km NW of VABM Never	65º 28.954' N 143º 36.482' W	M. B. Cook & A. Larsen	02-476	02 08 2002	
HIPPURIS MONTANA Ledeb.	Gravel bar 1.4 km E of mouth of Easy Moose Creek	65º 27.261' N 142º 06.016' W	M. B. Cook & A. Larsen	02-672B	06 08 2002	
HIPPURIS MONTANA Ledeb.	Wetland complex, N bank of Yukon R, 3.7 km S of VABM Pseudo	65º 22.380' N 142º 56.733' W	M. B. Cook & A. Larsen	02-727	06 08 2002	
Hydrophyllaceae						
PHACELIA SERICEA (Grah.) A. Gray	S facing slopes at base of Kathul Mt., Yukon R	65º 20.143' N 142º 17.950' W	A. Larsen & A. Batten	02-1262b	11 06 2002	
PHACELIA MOLLIS Macbr.	Hills on the W bank of the Diamond Fork of the Seventymile R, Yukon-Tanana Uplands	64º 52.616' N 142º 49.355' W	A. Larsen & D. Person	02-1723	01 07 2002	
PHACELIA MOLLIS Macbr.	Bluff on Copper Creek	64º 50.42' N 143º 14.24' W	M. B. Cook & B. Bennett	02-246	01 07 2002	conf. C. Parker (ALA) 03/2002
PHACELIA MOLLIS Macbr.	Gravel bar and stream corridor at mouth of Sevenmile Creek	65º 15.17' N 141º 38.69' W	M. B. Cook & A. Larsen	02-638	05 08 2002	conf. C. Parker (ALA) 03/2002
PHACELIA MOLLIS Macbr.	Gravel bar 1.5 km upstream of mouth of Judge Creek	65º 27.19' N 142º 13.09' W	M. B. Cook & A. Larsen	02-640	05 08 2002	conf. C. Parker (ALA) 03/2002
PHACELIA MOLLIS Macbr.	Gravel bar 1.4 km E of mouth of Easy Moose Creek	65º 27.261' N 142º 06.016' W	M. B. Cook & A. Larsen	02-654	06 08 2002	conf. C. Parker (ALA) 03/2002
Lamiaceae						
LYCOPUS UNIFLORUS Michx.	Vic. of pond 0.5 km E of mouth of Eureka Cr., Yukon R	65º 26.231' N 143º 33.772' W	A. Larsen & A. Batten	02-2297	22 07 2002	conf. A. Batten (ALA) 02/2003
LYCOPUS UNIFLORUS Michx.	Large bog system on N bank of Yukon R, 1.8 km downstream of mouth of Kandik R, Yukon R	65º 23.370' N 142º 31.992' W	A. Larsen & A. Batten	02-2405a	24 07 2002	conf. A. Batten (ALA) 02/2003
LYCOPUS UNIFLORUS Michx.	Wetland complex along N bank of Yukon R, opposite Tacoma Bluff 2.7 km W of VABM Never, Yukon R	65º 28.467' N 143º 37.181' W	A. Larsen & M. B. Cook	02-2448	02 08 2002	conf. A. Batten (ALA) 02/2003
LYCOPUS UNIFLORUS Michx.	Small lake along N bank of Yukon R, 6.7 km W of VABM Witch, Yukon R	65º 19.23' N 142º 03.75' W	M. B. Cook & A. Larsen	02-587	05 08 2002	
Liliaceae						

Taxon	Locality	Collection Site	Collectors	Collection Number	Date	Determination
TOFIELDIA GLUTINOSA (Michx.) Pers.	Small bog on N bank of Yukon R, 2.1 km downstream of mouth of Kandik R	65º 23.335' N 142º 32.416' W	A. Larsen & A. Batten	02-2385a	24 07 2002	
TOFIELDIA GLUTINOSA (Michx.) Pers.	Oxbow and bog within Andrew Cr Flats adjacent to Yukon R, 0.9 km NW of mouth of Andrew Cr, Yukon R	65º 22.359' N 143º 02.224' W	A. Larsen & M. B. Cook	02-2480	03 08 2002	
Najadaceae						
NAJAS FLEXILIS (Willd.) Rostkov. & Schmidt	Large bog complex along Yukon R corridor 5.2 km SW of VABM Wedge, Yukon R	65º 22.823' N 143º 27.269' W	A. Larsen & A. Batten	02-2333	22 07 2002	
NAJAS FLEXILIS (Willd.) Rostkov. & Schmidt	Vic. of small pond along Yukon R, 1.2 km downstream of Woodchopper Roadhouse, Yukon R	65º 21.198' N 143º 19.238' W	A. Larsen & A. Batten	02-2369	23 07 2002	
NAJAS FLEXILIS (Willd.) Rostkov. & Schmidt	Large bog system on N bank of Yukon R, 1.8 km downstream of mouth of Kandik R, Yukon R	65º 23.370' N 142º 31.992' W	A. Larsen & A. Batten	02-2397	24 07 2002	
NAJAS FLEXILIS (Willd.) Rostkov. & Schmidt	Wetland complex along N bank of Yukon R, opposite Tacoma Bluff 2.7 km W of VABM Never	65º 28.467' N 143º 37.181' W	A. Larsen & M. B. Cook	02-2455	02 08 2002	
NAJAS FLEXILIS (Willd.) Rostkov. & Schmidt	Vic. small pond adjacent to Yukon R in most western edge of Andrew Cr Flats, 1.5 km N of McGregor's Cabin	65º 22.175' N 143º 10.527' W	A. Larsen & M. B. Cook	02-2456	03 08 2002	
NAJAS FLEXILIS (Willd.) Rostkov. & Schmidt	Wetlands along N bank of Yukon R, at base of Kathul Mt, Yukon R	65º 20.034' N 142º 19.692' W	A. Larsen & M. B. Cook	02-2520	04 08 2002	
NAJAS FLEXILIS (Willd.) Rostkov. & Schmidt	Vic. of small lake along N bank of Yukon R, 6.7 km W of VABM Witch	65º 19.225' N 142º 03.772' W	A. Larsen & M. B. Cook	02-2549	05 08 2002	
NAJAS FLEXILIS (Willd.) Rostkov. & Schmidt	Small pond adjacent to Yukon R in most western edge of Andrew Cr Flats, 1.5 km N of McGregor's Cabin	65º 22.19' N 143º 10.54' W	M. B. Cook & A. Larsen	02-519	03 08 2002	
Orchidaceae						
MALAXIS PALUDOSA (L.) Sw.	Large bog system on N bank of Yukon R, 1.8 km downstream of mouth of Kandik R, Yukon R	65º 23.370' N 142º 31.992' W	A. Larsen & A. Batten	02-2391	24 07 2002	
MALAXIS PALUDOSA (L.) Sw.	Large lake adjacent to Yukon R 0.9 km NW of mouth of Kandik R, Yukon R	65º 23.019' N 142º 31.072' W	A. Larsen & A. Batten	02-2419	24 07 2002	
Papaveraceae						

Taxon	Locality	Collection Site	Collectors	Collection Number	Date	Determination
PAPAVER NUDICAULE L.	Saddle along NE flank of Jones Ridge, Ogilvie Mts	65º 07.136' N 141º 00.287' W	A. Larsen & A. Batten	02-1423	20 06 2002	
PAPAVER NUDICAULE L. ssp. AMERICANUM Randel	Gravel bar and stream corridor at mouth of Sevenmile Creek	65º 15.17' N 141º 38.69' W	M. B. Cook & A. Larsen	02-619	05 08 2002	
PAPAVER NUDICAULE L. ssp. AMERICANUM Randel	S-facing Dryas-willow tundra on E-W trending ridge	65º 16.55' N 141º 07.77' W	M. B. Cook & B. Bennett	02-036	25 06 2002	conf. C. Parker (ALA) 03/2002
PAPAVER NUDICAULE L. ssp. AMERICANUM Randel	Rocky Dryas-forb tundra on Mt. Sorenson	65º 00.26' N 142º 49.73' W	M. B. Cook & B. Bennett	02-181	29 06 2002	conf. C. Parker (ALA) 03/2002
PAPAVER NUDICAULE L. ssp. AMERICANUM Randel	Rocky Dryas tundra on Mt. Sorenson	65º 00.19' N 142º 45.61' W	M. B. Cook & C. Roland	02-439	19 07 2002	det. C. Parker (ALA) 03/2002
Plumbaginaceae						
ARMERIA MARITIMA (Mill.) Willd. ssp. ARCTICA (Cham.) Hult.	Moist spring area on eastern flank of Mt. Sorenson, 800 m NE of summit, Mt. Sorenson	64º 59.772' N 142º 55.947' W	A. Larsen & D. Person	02-1633	29 06 2002	
ARMERIA MARITIMA (Mill.) Willd. ssp. ARCTICA (Cham.) Hult.	Rocky Dryas-forb tundra on Mt. Sorenson	65º 00.26' N 142º 49.73' W	M. B. Cook & B. Bennett	02-178	29 6 2002	
Poaceae						
GLYCERIA PULCHELLA (Nash) K. Schum.	Large lake adjacent to Yukon R 0.9 km NW of mouth of Kandik R, Yukon R	65º 23.019' N 142º 31.072' W	A. Larsen & A. Batten	02-2411	24 07 2002	conf. C. Parker (ALA) 02/2003
PHLEUM ALPINUM L.	Gravel bar and stream corridor at mouth of Sevenmile Cr, Kandik R	65º 24.807' N 142º 22.673' W	A. Larsen & M. B. Cook	02-2585	05 08 2002	
PHLEUM ALPINUM L.	Scattered in mesic forb herbaceous meadow Mt. Casca, Ogilvie Mts	65º 20.34' N 141º 03.19' W	M. B. Cook & B. Bennett	02-080	26 6 2002	
POA PORSILDII Gjaer.	W facing valley along NE flank of Jones Ridge, Ogilvie Mts	65º 07.105' N 141º 00.370' W	A. Larsen & A. Batten	02-1325	19 06 2002	conf. C. Parker (ALA) 02/2003
POA PORSILDII Gjaer.	W facing valley along NE flank of Jones Ridge, Ogilvie Mts	65º 07.105' N 141º 00.370' W	A. Larsen & A. Batten	02-1343	19 06 2002	conf. C. Parker (ALA) 02/2003
POA PORSILDII Gjaer.	Saddle 2.04 km E of VABM Pack, Ogilvie Mts	65º 09.526' N 141º 01.686' W	A. Larsen & A. Batten	02-1366	19 06 2002	conf. C. Parker (ALA) 02/2003
POA PORSILDII Gjaer.	W facing valley along NE flank of Jones Ridge, Ogilvie Mts	65º 07.105' N 141º 00.370' W	A. Larsen & A. Batten	02-1376	19 06 2002	conf. C. Parker (ALA) 02/2003

Taxon	Locality	Collection Site	Collectors	Collection Number	Date	Determination
POA PORSILDII Gjaer.	Lower portion of ridge between Tindir and Waterfall Creeks, 4.9 km S of VABM Casca, Ogilvie Mts	65º 12.13' N 141º 04.678' W	A. Larsen & D. Person	02-1449a	24 06 2002	conf. C. Parker (ALA) 02/2003
POA PORSILDII Gjaer.	Lower portion of ridge between Tindir and Waterfall Creeks, 4.9 km S of VABM Casca, Ogilvie Mts	65º 12.13' N 141º 04.678' W	A. Larsen & D. Person	02-1450	24 06 2002	conf. C. Parker (ALA) 02/2003
POA PORSILDII Gjaer.	S facing slope at North Ogilvie Base Camp, ridge between Tindir and Waterfall Creeks, 4.9 km S of VABM Casca, Ogilvie Mts	65º 18.209' N 141º 04.678' W	A. Larsen & D. Person	02-1480	25 06 2002	det. C. Parker (ALA) 02/2003
POA PORSILDII Gjaer.	Ridgeline along Canadian border 4.3 km NE of VABM Pack, Ogilvie Mts	65º 11.041' N 141º 00.041' W	A. Larsen & D. Person	02-1532	25 06 2002	conf. C. Parker (ALA) 02/2003
POA PORSILDII Gjaer.	Spur ridge S of North Ogilvie base camp, 6.3 km S of VABM Casca, Ogilvie Mts	65º 18.157' N 141º 03.543' W	A. Larsen & D. Person	02-1558	26 06 2002	conf. C. Parker (ALA) 02/2003
POA PORSILDII Gjaer.	Mountains dividing the Goodpaster and Charley R drainages, 17.5 km N of VABM Paster, Yukon-Tanana Uplands	64º 32.385' N 143º 42.126' W	A. Larsen, B. Bennett & M. Cook	02-2014	07 07 2002	det. C. Parker (ALA) 02/2003
POA PORSILDII Gjaer	Vic. Nimrod Pk., Ogilvie Mts	65º 04.516' N 141º 06.124' W	C. Roland, J. Brodie & E. Groth	5364	17 06 2002	conf. C. Parker (ALA) 01/2003
POA PORSILDII Gjaer.	Saddle between Squaw and Nimrod Peaks, Ogilvie Mts	65º 04.323' N 141º 02.555' W	C. Roland, J. Brodie & E. Groth	5379	18 06 2002	conf. C. Parker (ALA) 01/2003
POA PORSILDII Gjaer.	Saddle between Squaw and Nimrod Peaks, Ogilvie Mts	65º 04.323' N 141º 02.555' W	C. Roland, J. Brodie & E. Groth	5434	19 06 2002	conf. C. Parker (ALA) 01/2003
POA PORSILDII Gjaer.	E-W trending ridge	65º 16.55' N 141º 07.77' W	M. B. Cook & B. Bennett	02-035	25 06 2002	conf. C. Parker (ALA) 2002
POA PORSILDII Gjaer.	Alpine plateau on upper Copper Creek	64º 48.16' N 143º 53.83' W	M. B. Cook & B. Bennett	02-280A	01 07 2002	conf. C. Parker (ALA) 2002
POA PORSILDII Gjaer.	Alpine plateau on upper Copper Creek	64º 48.16' N 143º 53.83' W	M. B. Cook & B. Bennett	02-280B	01 07 2002	conf. C. Parker (ALA) 2002
POA PORSILDII Gjaer.	Mt. Casca, Ogilvie Mts	65º 20.34' N 141º 03.19' W	M. B. Cook & B. Bennett	02-056	26 06 2002	conf. C. Parker (ALA) 2002
POA PORSILDII Gjaer.	Mt. Casca, Ogilvie Mts	65º 20.34' N 141º 03.19' W	M. B. Cook & B. Bennett	02-082	26 06 2002	conf. C. Parker (ALA) 2002

Taxon	Locality	Collection Site	Collectors	Collection Number	Date	Determination
POA PORSILDII Gjaer.	Mt. Casca, Ogilvie Mts	65º 20.34' N 141º 03.19' W	M. B. Cook & B. Bennett	02-083	26 06 2002	conf. C. Parker (ALA) 2002
POA PORSILDII Gjaer.	Mt. Casca, Ogilvie Mts	65º 20.34' N 141º 03.19' W	M. B. Cook & B. Bennett	02-096A	27 06 2002	
POA PORSILDII Gjaer.	Mt. Casca, Ogilvie Mts	65º 20.34' N 141º 03.19' W	M. B. Cook & B. Bennett	02-105	27 06 2002	conf. C. Parker (ALA) 2002
POA PORSILDII Gjaer.	Monument 99, Ogilvie Mts	65º 16.55' N 141º 01.18' W	M. B. Cook & B. Bennett	02-147	28 06 2002	conf. C. Parker (ALA) 2002
POA PORSILDII Gjaer.	Mt. Sorenson	65º 00.24' N 142º 50.51' W	M. B. Cook & B. Bennett	02-201	29 06 2002	conf. C. Parker (ALA) 2002
PUCCINELLIA INTERIOR Sorens.	Coal Creek and associated wetlands 13.1 km SW of Coal Cr Camp, Yukon-Tanana Uplands	65º 15.197' N 143º 23.969' W	A. Larsen, B. Bennett & M. Cook	02-1831	03 07 2002	conf. C. Parker (ALA) 02/2003
Polygonaceae						
KOENIGIA ISLANDICA L.	Upper Charley R drainage, 5.6 km SE of VABM Copper	64º 38.671' N 143º 10.72' W	C. Roland	5690	17 07 2002	conf. C. Parker (ALA) 01/2003
KOENIGIA ISLANDICA L.	16.5 km S of VABM Copper Large barren mud sink with extensive caribou tracks	64º 31.606' N 143º 14.243' W	C. Roland	5664	16 07 2002	conf. C. Parker (ALA) 01/2003
KOENIGIA ISLANDICA L.	Upper Charley R	64º 36.93' N 143º 56.39' W	M. B. Cook & C. Roland	02-413B	18 07 2002	
RUMEX ACETOSA L. ssp. ALPESTRIS (Scop.) Love	Mesic swale in dryas-forb tundra on Mt. Sorenson	65º 00.27' N 142º 49.22' W	M. B. Cook & B. Bennett	02-172	29 06 2002	
Polypodiaceae						
POLYPODIUM SIBIRICUM Sipliv.	Riparian corridor along Cr entering Yukon in middle of Biederman Bluff, Yukon R	65º 24.068' N 142º 38.544' W	A. Larsen & A. Batten	02-1285	12 06 2002	
Portulaceae						
CLAYTONIA SCAMMANIANA Hult.	Eastern flank of Mt. Sorenson, 800 m NE of summit, Mt. Sorenson	64º 59.772' N 142º 55.947' W	A. Larsen & D. Person	02-1619	29 06 2002	
MONTIA BOSTOCKII (Pors.) Welsh	Large rock outcrops in the Three Fingers area of the upper Charley R, 6.8 km SE of VABM Copper, Yukon-Tanana Uplands	64º 39.345' N 143º 07.342' W	A. Larsen	02-2183	10 07 2002	conf. A. Batten (ALA) 02/2003
MONTIA BOSTOCKII (Pors.) Welsh	Mountains dividing the Goodpaster and Charley R drainages, 17.5 km N of VABM Paster, Yukon-Tanana Uplands	64º 32.385' N 143º 42.126' W	A. Larsen, B. Bennett & M. Cook	02-1945	04 07 2002	conf. A. Batten (ALA) 02/2003

Taxon	Locality	Collection Site	Collectors	Collection Number	Date	Determination
MONTIA BOSTOCKII (Pors.) Welsh	Ridge on S boundary of Preserve, 9.3 km E/SE of VABM Edge	64º 35.22' N 143º 55.73' W	C. Roland	5701A	18 07 2002	conf. C. Parker (ALA) 01/2003
MONTIA FONTANA L.	16.5 km S of VABM Copper. Large barren mud sink with extensive caribou tracks	64º 31.606' N 143º 14.243' W	C. Roland	5663	16 07 2002	conf. C. Parker (ALA) 01/2003
Potamogetonaceae						
POTAMOGETON EPIHYDRUS Raf.	Vic. of pond 0.5 km E of mouth of Eureka Cr., Yukon R	65º 26.231' N 143º 33.772' W	A. Larsen & A. Batten	02-2281	22 07 2002	
POTAMOGETON EPIHYDRUS Raf.	Vic. of small pond and bog complex on S bank of Yukon R, opposite Biederman Bluff, Yukon R	65º 22.744' N 142º 36.008' W	A. Larsen & M. B. Cook	02-2636	06 08 2002	
POTAMOGETON FOLIOSUS Raf.	Wetland complex, N bank of Yukon R, 3.7 km S of VABM Pseudo	65º 22.380' N 142º 56.733' W	M. B. Cook & A. Larsen	02-728	06 08 2002	conf. C. Parker (ALA) 03/2002
POTAMOGETON FRIESII Rupr.	Wetland complex along N bank of Yukon R, opposite Tacoma Bluff 2.7 km W of VABM Never,	65º 28.467' N 143º 37.181' W	A. Larsen & M. B. Cook	02-2443	02 08 2002	
POTAMOGETON FRIESII Rupr.	Vic. small pond adjacent to Yukon R in most western edge of Andrew Cr Flats, 1.5 km N of McGregor's Cabin	65º 22.175' N 143º 10.527' W	A. Larsen & M. B. Cook	02-2459	03 08 2002	
POTAMOGETON FRIESII Rupr.	Wetlands along N bank of Yukon R, at base of Kathul Mt, Yukon R	65º 20.034' N 142º 19.692' W	A. Larsen & M. B. Cook	02-2525	04 08 2002	
POTAMOGETON FRIESII Rupr.	Vic. of small lake along N bank of Yukon R, 6.7 km W of VABM Witch	65º 19.225' N 142º 03.772' W	A. Larsen & M. B. Cook	02-2545	05 08 2002	
POTAMOGETON FRIESII Rupr.	Gravel bar and stream corridor at mouth of Sevenmile Cr, Kandik R	65º 24.807' N 142º 22.673' W	A. Larsen & M. B. Cook	02-2567b	05 08 2002	
POTAMOGETON FRIESII Rupr. ssp. TENUISSIMUS (Mert. & Koch) Haynes & Hellq.	In 1 ft of water in small pond and bog complex on S bank of Yukon R	65º 22.75' N 142º 36.02' W	M. B. Cook & A. Larsen	02-687	06 08 2002	det. C. Parker (ALA) 03/2002
POTAMOGETON NATANS L.	Stream corridor and ponds along the Diamond Fork of the Seventymile R, 5.9 km N of VABM Chen, Yukon-Tanana Uplands	64º 53.604' N 142º 48.677' W	A. Larsen	02-2222	11 07 2002	
POTAMOGETON NATANS L.	Vic. of pond 0.5 km E of mouth of Eureka Cr., Yukon R	65º 26.231' N 143º 33.772' W	A. Larsen & A. Batten	02-2293	22 07 2002	
POTAMOGETON NATANS L.	Large bog system on N bank of Yukon R, 1.8 km downstream of mouth of Kandik R, Yukon R	65º 23.370' N 142º 31.992' W	A. Larsen & A. Batten	02-2406	24 07 2002	

Taxon	Locality	Collection Site	Collectors	Collection Number	Date	Determination
POTAMOGETON NATANS L.	Wetland complex along N bank of Yukon R, opposite Tacoma Bluff 2.7 km W of VABM Never	65º 28.467' N 143º 37.181' W	A. Larsen & M. B. Cook	02-2449	02 08 2002	
POTAMOGETON NATANS L.	Coal Creek and associated wetlands 13.1 km SW of Coal Cr Camp, Yukon-Tanana Uplands	65º 15.197' N 143º 23.969' W	A. Larsen, B. Bennett & M. Cook	02-1837	03 07 2002	
POTAMOGETON NATANS L.	Oxbow and bog adjacent to Yukon R, 0.9 km NW of mouth of Andrew Creek	65º 22.76' N 143º 07.33' W	M. B. Cook & A. Larsen	02-526	03 08 2002	conf. C. Parker (ALA) 03/2002
POTAMOGETON OBTUSIFOLIUS Mert. & Koch	Wetland adjacent to Charley R, 5.2 km upstream of mouth of Charley R, Yukon-Tanana Upland	65º 16.866' N 142º 42.650' W	A. Larsen	02-2239	11 07 2002	conf. C. Parker (ALA) 02/2003
POTAMOGETON OBTUSIFOLIUS Mert. & Koch	Large bog system on N bank of Yukon R, 1.8 km downstream of mouth of Kandik R, Yukon R	65º 23.370' N 142º 31.992' W	A. Larsen & A. Batten	02-2395	24 07 2002	conf. C. Parker (ALA) 02/2003
POTAMOGETON OBTUSIFOLIUS Mert. & Koch	Large lake adjacent to Yukon R 0.9 km NW of mouth of Kandik R, Yukon R	65º 23.019' N 142º 31.072' W	A. Larsen & A. Batten	02-2422	24 07 2002	conf. C. Parker (ALA) 02/2003
POTAMOGETON OBTUSIFOLIUS Mert. & Koch	Large bog system on N bank of Yukon R, 1.8 km downstream of mouth of Kandik R, Yukon R	65º 23.370' N 142º 31.992' W	A. Larsen & A. Batten	02-2405b	24 07 2002	det. C. Parker (ALA) 02/2003
POTAMOGETON OBTUSIFOLIUS Mert. & Koch	Vic. small pond adjacent to Yukon R in most western edge of Andrew Cr Flats, 3 km N of Slaven's Cabin, Yukon R	65º 22.724' N 143º 07.536' W	A. Larsen & M. B. Cook	02-2477	03 08 2002	conf. C. Parker (ALA) 02/2003
POTAMOGETON OBTUSIFOLIUS Mert. & Koch	Gravel bar along Nation R, 6.5 km NW of VABM Half, Yukon R	65º 15.240' N 141º 38.625' W	A. Larsen & M. B. Cook	02-2567a	05 08 2002	conf. C. Parker (ALA) 02/2003
POTAMOGETON OBTUSIFOLIUS Mert. & Koch	Vic. of small pond and bog complex on S bank of Yukon R, opposite Biederman Bluff, Yukon R	65º 22.744' N 142º 36.008' W	A. Larsen & M. B. Cook	02-2632	06 08 2002	conf. C. Parker (ALA) 02/2003
POTAMOGETON OBTUSIFOLIUS Mert. & Koch	Vic. of small pond and bog complex on S bank of Yukon R, opposite Biederman Bluff, Yukon R	65º 22.744' N 142º 36.008' W	A. Larsen & M. B. Cook	02-2638	06 08 2002	det. C. Parker (ALA) 02/2003
POTAMOGETON ZOSTERIFORMIS Fern.	Large bog system on N bank of Yukon R, 1.8 km downstream of mouth of Kandik R, Yukon R	65º 23.370' N 142º 31.992' W	A. Larsen & A. Batten	02-2393	24 07 2002	
POTAMOGETON ZOSTERIFORMIS Fern.	Vic. small pond adjacent to Yukon R in most western edge of Andrew Cr Flats, 1.5 km N of McGregor's Cabin	65º 22.175' N 143º 10.527' W	A. Larsen & M. B. Cook	02-2458	03 08 2002	

Taxon	Locality	Collection Site	Collectors	Collection Number	Date	Determination
POTAMOGETON ZOSTERIFORMIS Fern.	Vic. of small lake along N bank of Yukon R, 6.7 km W of VABM Witch	65º 19.225' N 142º 03.772' W	A. Larsen & M. B. Cook	02-2542	05 08 2002	
POTAMOGETON ZOSTERIFORMIS Fern.	Small pond adjacent to Yukon R in most western edge of Andrew Cr Flats, 1.5 km N of McGregor's Cabin	65º 22.19' N 143º 10.54' W	M. B. Cook & A. Larsen	02-508	03 08 2002	conf. C. Parker (ALA) 03/2002
Primulaceae						
DOUGLASIA GORMANII Const.	Mt. Casca, Ogilvie Mounains	65º 20.34' N 141º 03.19' W	M. B. Cook B. Bennett	02-117	27 06 2002	det. C. Parker (ALA) 05/2004
DOUGLASIA GORMANII Const.	Saddle 2.04 km E of VABM Pack, Ogilvie Mts	65º 09.526' N 141º 01.686' W	A. Larsen & A. Batten	02-1405	19 06 2002	
DOUGLASIA GORMANII Const.	Spur ridge S of North Ogilvie base camp, 6.3 km S of VABM Casca, Ogilvie Mts	65º 18.157' N 141º 03.543' W	A. Larsen & D. Person	02-1564	26 06 2002	
DOUGLASIA GORMANII Const.	Eastern flank of Mt. Sorenson, 800 m NE of summit, Mt. Sorenson	64º 59.772' N 142º 55.947' W	A. Larsen & D. Person	02-1593	29 06 2002	
DOUGLASIA GORMANII Const.	Hills on the W bank of the Diamond Fork of the Seventymile R, Yukon-Tanana Uplands	64º 52.616' N 142º 49.355' W	A. Larsen & D. Person	02-1730	01 07 2002	
DOUGLASIA GORMANII Const.	Alpine ridge above Seventymile R, 9 km E of Mt. Sorenson	65º 00.19' N 142º 45.61' W	C. Roland	5717	19 07 2002	conf. C. Parker (ALA) 01/2003
DOUGLASIA GORMANII Const.	Ridge dividing upper Essie Cr. from Seventymile R drainage, 6.6 km SW of Mt. Sorensen, Yukon-Tanana Uplands	64º 57.988' N 143º 05.144' W	C. Roland	5494	21 06 2002	conf. C. Parker (ALA) 01/2003
DOUGLASIA GORMANII Const.	Monument 99, Ogilvie Mts	65º 16.55' N 141º 01.18' W	M. B. Cook & B. Bennett	02-138	28 06 2002	conf. C. Parker (ALA) 03/2003
DOUGLASIA GORMANII Const.	Mt. Sorenson	65º 00.19' N 142º 45.61' W	M. B. Cook & C. Roland	02-437	19 07 2002	
PRIMULA MISTASSINICA Michx.	Saddle along NE flank of Jones Ridge, Ogilvie Mts	65º 07.136' N 141º 00.287' W	A. Larsen & A. Batten	02-1306	18 06 2002	conf. C. Parker (ALA) 02/2003
PRIMULA MISTASSINICA Michx.	Saddle 2.04 km E of VABM Pack, Ogilvie Mts	65º 09.526' N 141º 01.686' W	A. Larsen & A. Batten	02-1389	19 06 2002	det. C. Parker (ALA) 02/2003
PRIMULA MISTASSINICA Michx.	Knoll Between Tindir and Waterfall Creeks, 7.6 km NE of Nation Hill, Ogilvie Mts	65º 18.851' N 141º 06.593' W	A. Larsen & D. Person	02-1550	25 06 2002	
PRIMULA MISTASSINICA Michx.	E-W trending ridge	65º 16.55' N 141º 07.77' W	M. B. Cook & B. Bennett	02-038	25 06 2002	det. C. Parker (ALA) 03/2002
PRIMULA MISTASSINICA Michx.	Mt. Sorenson	65º 00.24' N 142º 50.51' W	M. B. Cook & B. Bennett	02-199	29 06 2002	

Taxon	Locality	Collection Site	Collectors	Collection Number	Date	Determination
Ranunculaceae						
RANUNCULUS GLACIALIS L. ssp. CHAMISSONIS (Schlecht.) Hult.	Stream corridor and ponds along the Diamond Fork of the Seventymile R, 5.9 km N of VABM Chen, Yukon-Tanana Uplands	64º 53.604' N 142º 48.677' W	A. Larsen	02-2191	11 07 2002	
RANUNCULUS GLACIALIS L. ssp. CHAMISSONIS (Schlecht.) Hult.	Hills on the W bank of the Diamond Fork of the Seventymile R, Yukon-Tanana Uplands	64º 52.616' N 142º 49.355' W	A. Larsen & D. Person	02-1705	01 07 2002	
RANUNCULUS MACOUNII Britt.	Small wet meadow along N bank of Yukon R, at base of Kathul Mt	65º 20.213' N 142º 19.459' W	A. Larsen & M. B. Cook	02-2526	04 08 2002	
RANUNCULUS MACOUNII Britt.	Dry pond on N bank of Yukon R	65º 20.22' N 142º 19.44' W	M. B. Cook & A. Larsen	02-573	04 08 2002	det. C. Parker (ALA) 03/2002
Salicaceae						
SALIX CANDIDA Flugge	Large bog complex along Yukon R corridor 5.2 km SW of VABM	65º 22.823' N 143º 27.269' W	A. Larsen & A. Batten	02-2347	22 07 2002	
SALIX CANDIDA Flugge	Wetland complex along N bank of Yukon R, opposite Tacoma Bluff 2.3 km NW of VABM Never, Yukon R	65º 28.954' N 143º 36.482' W	A. Larsen & M. B. Cook	02-2434	02 08 2002	
SALIX CANDIDA Flugge	Wetlands along N bank of Yukon R, opposite Tacoma Bluff, 2.3 km NW of VABM Never	65º 28.954' N 143º 36.482' W	M. B. Cook & A. Larsen	02-492A	02 08 2002	
SALIX CANDIDA Flugge	Oxbow and bog adjacent to Yukon R, 0.9 km NW of mouth of Andrew Creek	65º 22.76' N 143º 07.33' W	M. B. Cook & A. Larsen	02-540	03 08 2002	
SALIX COMMUTATA Bebb	Vic. of pond 0.5 km E of mouth of Eureka Cr., Yukon R	65º 26.231' N 143º 33.772' W	A. Larsen & A. Batten	02-2315	22 07 2002	conf. C. Parker (ALA) 02/2003
SALIX COMMUTATA Bebb	Small pond adjacent to Yukon R, in most western edge of Andrew Cr Flats, 1.5 km N of McGregor's Cabin	65º 22.19' N 143º 10.54' W	M. B. Cook & A. Larsen	02-502	03 08 2002	
SALIX COMMUTATA Bebb	Large lake on N bank of Yukon R, 4.3 km upstream of Kandik R mouth	65º 21.14' N 142º 25.70' W	M. B. Cook & A. Larsen	02-561A	04 08 2002	
SALIX COMMUTATA Bebb	Wetland complex, N bank of Yukon R, 3.7 km S of VABM Pseudo	65º 22.025' N 142º 56.182' W	M. B. Cook & A. Larsen	02-707	06 08 2002	

Taxon	Locality	Collection Site	Collectors	Collection Number	Date	Determination
Saxifragaceae						
BOYKINIA RICHARDSONII (Hook.) Gray	Copper Hills, 1.5 km S of VABM Copper, Yukon-Tanana Uplands	64º 39.800' N 143º 16.381' W	A. Larsen	02-2118	10 07 2002	
BOYKINIA RICHARDSONII (Hook.) Gray	Extreme headwaters of Alder Creek at divide to Yukon Fork of South Fork Birch Cr, 14.1 km W of Mt. Kathryn, Yukon-Tanana Uplands	65º 12.240' N 143º 49.822' W	A. Larsen & B. Bennett	02-2029	08 07 2002	
BOYKINIA RICHARDSONII (Hook.) Gray	Alpine plateau 3.8 km NW of VABM Chen, Yukon-Tanana Uplands	64º 52.145' N 142º 55.859' W	A. Larsen & D. Person	02-1678	01 07 2002	
BOYKINIA RICHARDSONII (Hook.) Gray	Mountains dividing the Goodpaster and Charley R drainages, 17.5 km N of VABM Paster, Yukon-Tanana Uplands	64º 32.385' N 143º 42.126' W	A. Larsen, B. Bennett & M. Cook	02-1898	04 07 2002	
BOYKINIA RICHARDSONII (Hook.) Gray	Mountains dividing the Goodpaster and Charley R drainages, 17.5 km N of VABM Paster, Yukon-Tanana Uplands	64º 32.385' N 143º 42.126' W	A. Larsen, B. Bennett & M. Cook	02-1961	04 07 2002	
BOYKINIA RICHARDSONII (Hook.) Gray	Saddle between Squaw and Nimrod Peaks, Ogilvie Mts	65º 04.323' N 141º 02.555' W	C. Roland, J. Brodie & E. Groth	5436	19 06 2002	conf. C. Parker (ALA) 01/2003
BOYKINIA RICHARDSONII (Hook.) Gray	Alpine plateau on upper Copper Creek	64º 48.16' N 143º 53.83' W	M. B. Cook & B. Bennett	02-268	01 07 2002	
BOYKINIA RICHARDSONII (Hook.) Gray	Mt. Sorenson	65º 00.24' N 142º 50.51' W	M. B. Cook & B. Bennett	02-186	29 06 2002	
BOYKINIA RICHARDSONII (Hook.) Gray	Alpine basin at head of Charley R	64º 43.71' N 143º 50.51' W	M. B. Cook & C. Roland	02-354	17 07 2002	
SAXIFRAGA SPICATA D. Don	Riparian corridor along Cr entering Yukon in middle of Biederman Bluff, Yukon R	65º 24.068' N 142º 38.544' W	A. Larsen & A. Batten	02-1286	12 06 2002	
SAXIFRAGA SPICATA D. Don	Coal Creek and associated wetlands 13.1 km SW of Coal Cr Camp, Yukon-Tanana Uplands	65º 15.197' N 143º 23.969' W	A. Larsen, B. Bennett & M. Cook	02-1800	03 07 2002	

Taxon	Locality	Collection Site	Collectors	Collection Number	Date	Determination
Scheutzeriaceae						
SCHEUCHZERIA PALUSTRIS L.	Small bog on N bank of Yukon R, 2.1 km downstream of mouth of Kandik R	65º 23.335' N 142º 32.416' W	A. Larsen & A. Batten	02-2380	24 07 2002	
SCHEUCHZERIA PALUSTRIS L.	Wetland complex on N bank of Yukon R, 4.6 km upstream of mouth of Kandik R, Yukon R	65º 20.717' N 142º 26.496' W	A. Larsen & A. Batten	02-2428	25 07 2002	
SCHEUCHZERIA PALUSTRIS L.	Wetland complex along N bank of Yukon R, opposite Tacoma Bluff 2.7 km W of VABM Never	65º 28.467' N 143º 37.181' W	A. Larsen & M. B. Cook	02-2447	02 08 2002	
Scrophulariaceae						
PEDICULARIS MACRODONTA Rich.	Large bog complex along Yukon R corridor 5.2 km SW of VABM Wedge	65º 22.823' N 143º 27.269' W	A. Larsen & A. Batten	02-2331	22 07 2002	
PEDICULARIS MACRODONTA Rich.	Large bog system on N bank of Yukon R, 1.8 km downstream of mouth of Kandik R, Yukon R	65º 23.370' N 142º 31.992' W	A. Larsen & A. Batten	02-2401	24 07 2002	
PEDICULARIS MACRODONTA Rich.	Oxbow and bog within Andrew Cr Flats adjacent to Yukon R, 0.9 km NW of mouth of Andrew Cr	65º 22.359' N 143º 02.224' W	A. Larsen & M. B. Cook	02-2481	03 08 2002	
VERONICA SCUTELLATA L.	Small wet meadow along N bank of Yukon R, at base of Kathul Mt	65º 20.213' N 142º 19.459' W	A. Larsen & M. B. Cook	02-2538	04 08 2002	
VERONICA SCUTELLATA L.	Dry pond on N bank of Yukon R	65º 20.22' N 142º 19.44' W	M. B. Cook & A. Larsen	02-577A	04 08 2002	
Violaceae						
VIOLA RENIFOLIA Gray	N bank of Yukon R opposite VABM July at Nation Reef, Yukon R	65º 12.69' N 141º 49.45' W	A. Larsen & A. Batten	02-1263	11 06 2002	
VIOLA RENIFOLIA Gray	Upper Hard Luck Creek drainage - slope 5 km NW of Nimrod Pk., Ogilvie Mts	65º 06.329' N 141º 07.776' W	C. Roland, J. Brodie & E. Groth	5461	19 06 2002	conf. C. Parker (ALA) 01/2003
VIOLA SELKIRKII Pursh ex Goldie	W facing valley along NE flank of Jones Ridge, Ogilvie Mts	65º 07.105' N 141º 00.370' W	A. Larsen & A. Batten	02-1373	19 06 2002	conf. C. Parker (ALA) 02/2003

Plate 5.15. *Carex viridula*, a rare sedge, was found near Crescent Creek in the Yukon-Tanana Uplands. Photograph by C. Roland

Plate 5.16. *Cicuta bulbifera*, a rare umbel we collected in several wetlands along the Yukon River corridor. Photograph by A. Larsen

Plate 5.17. The rare plant species *Draba ogilviensis* was found in the Ogilvie Mountains. Photograph by B. Bennett.

Plate 5.18. *Montia fontana*, a diminutive forb, was found in a shallow wetland in the Three Fingers area of the Charley River watershed. Photograph by C. Roland.

***Oxytropis arctica* R. Br. "arctic oxytrope"**
This legume is distributed throughout Amphiberingia and appears on both sides of the Bering Strait. All four of our collections were from the Ogilvie Mountains in the northeastern corner of the Preserve. These collections extend the range of this species 310 km to the southeast. (Figure 5.3, Map 19)

***Pedicularis macrodonta* Richards.**
This large scroph is found in muskeg across boreal North America from southcentral Alaska to Hudson Bay. The distribution of this species is extremely patchy. We collected three specimens of this rare plant species that is ranked S3 by the Alaska Natural Heritage Program. Our specimens extend the range of this species 220 km to the northeast. (Figure 5.3, Map 20)

***Potamogeton epihydrus* Raf. "ribbonleaf pondweed"**
This pondweed has a patchy North American distribution that extends from the Aleutian Islands to Newfoundland. The collections we made from ponds along the Yukon River corridor extend the range of this species 520 km to the northeast from the Anchorage area. (Figure 5.3, Map 21)

***Potamogeton foliosus* Raf. "leafy pondweed"**
This species of Potamogeton is distributed across North America from Alaska to Newfoundland. It is unusual in Alaska and Yukon Territory. Our two collections of this species extend the range 140 km to the northwest from Eagle. (Figure 5.3, Map 22)

***Potamogeton natans* L. "floating-leaf pondweed"**
This circumpolar pondweed is found in North America from Newfoundland to Alaska with major gaps in its distribution. In Alaska the species is generally restricted to the subarctic. Our collections extend the range of this species 140 km northeast. (Figure 5.3, Map 23)

***Potamogeton obtusifolius* Mertens & Koch. "thick-leafed pondweed"**
This Amphiatlantic pondweed is distributed in North America from Labrador and Newfoundland to Ontario with scattered collections in British Columbia and Yukon Territory. There are few collections of this species in Alaska and it is ranked as S1 by the Alaska Natural Heritage Program. Collections of this species in Alaska (first reported in 1991) and Yukon Territory were only recently published by Cody in 2000. Our collections of this species extend the range 600 km northwest from a collection made along the Canol Road in Yukon Territory. (Figure 5.3, Map 24)

***Potamogeton zosteriformis* Fern. "flatstem pondweed"**
This species has a circumpolar distribution. In boreal North America this species is known from New Brunswick to Alaska with disjunct populations in the contiguous United States. This species is new to the Preserve and our four collections extend the range of this uncommon species 150 km southeast from collections near Fort Yukon. (Figure 5.3, Map 25)

***Ranunculus macounii* Britt.**
This species is distributed across North America from central Alaska to Labrador and Newfoundland. Our collection of this species from a wet meadow along the Yukon River corridor is a 150 km range extension from Circle, Alaska, and connects the range to specimens collected near Dawson, Yukon Territory. (Figure 5.3, Map 26)

***Ranunculus turneri* Greene**
This buttercup has an Amphiberingian distribution and is known in North America only from the northern portion of Yukon Territory. This species was collected in the Preserve in the Ogilvie Mountains near the Canadian Border. Our collection of this rare species extends the known range 150 km to the southwest from a collection off the Dempster Highway. (Figure 5.3, Map 27)

***Rumex acetosa* L. subsp. *alpestris* (Scop.) A. Löve "sorrel"**
This species is distributed throughout Amphiberingia. In Alaska, it is mostly found in western and central areas of the state. In the Yukon Territory, Cody (2000) reports localities north of Kluane Lake and in the Richardson Mountains. This species is new to the Preserve and our three collections found near Mt. Sorensen in the Yukon-Tanana Uplands extend the range of this species 250 km to the east. (Figure 5.3, Map 28)

***Sagittaria cuneata* Sheld. "arrowhead"**
This species is distributed across North America from Quebec to interior Alaska. Very few collections have been made of this species in Alaska. This species is new to the Preserve and our collection of it near the confluence of the Kandik and Yukon Rivers extends the range of this species 200 km to the southeast of Beaver, Alaska. (Plate 5.19; Figure 5.3, Map 29)

***Salix candida* Flügge**
This rare willow, ranked S2S3 by the Alaska Natural Heritage Program, is distributed throughout North America from Newfoundland to east central Alaska. The four collections made along the Yukon River corridor extend the range of this species 70 km to the southeast from Circle, Alaska, and connect the distribution with specimens collected near Mayo, Yukon Territory. (Figure 5.3, Map 30)

***Salix commutata* Bebb. "under-green willow"**
This low growing willow has a Cordilleran distribution and is found throughout Alaska and western Canada including British Columbia and Yukon Territory where it has been found as far north as the Canol Road. Our four collections of this species extend the range of this species 230 km to the northeast. These collections represent the northernmost collections of this species to date. (Figure 5.3, Map 31)

***Saxifraga spicata* D. Don "spiked saxifrage"**
This species is endemic to Alaska and Yukon Territory where it is known to inhabit moist rocky slopes along creeks. It is distributed throughout much of interior and western Alaska. Our collections extend the range of this species 110 km northeast from Chena

Plate 5.19. *Sagittaria cuneata*, a mud flat species, was collected on a lakeshore near the mouth of the Kandik River. This collection represented a 200 km range extension. Photograph by A. Larsen

Plate 5.20. This large rush, *Scirpus validus*, was collected from a lakeshore 180 km northwest of any previous published collections. Photograph by A. Larsen.

Hot Springs and connect the range to a collection near Dawson, Yukon Territory. (Figure 5.3, Map 32)

***Scheuchzeria palustris* L. ssp. *americana* (Fern.) Hultén "Scheuchzeria"**
This arrow-grass has a circumpolar distribution with major gaps. The species is described from Lapland, Sweden, Switzerland, and Prussia; this particular subspecies is found from Newfoundland and southern Labrador to Alaska. This subspecies has rarely been collected in Alaska or the Yukon Territory, where it is widely disjunct from its primary range. This subspecies is ranked S3 by the Alaska Natural Heritage Program. This species may often be overlooked due to the inhospitable habitat of bogs and quagmires it occupies. Our three collections of this subspecies along the Yukon River corridor extend the range 320 km northwest of collections in Yukon Territory. (Figure 5.3, Map 33)

***Scirpus validus* Vahl "softstem bulrush"**
This species is distributed across North America from Newfoundland to interior and southcentral Alaska. We collected this species from four ponds adjacent to the Yukon River. These collections extend the range of this wetland species 180 km to the northwest of its locality near Dawson, Yukon Territory. (Plate 5.20; Figure 5.3, Map 34)

***Sinapis arvensis* L. "charlock"**
This garden weed is distributed throughout North America from Labrador to British Columbia and Alaska. Our collection of this species near Coal Creek camp, a mining camp that has been in operation since the 1930's, extends the range of this species 190 km to the northwest of specimens from Dawson. Our collection is notable because previous interior Alaska collections have been restricted to the Tanana River drainage. (Figure 5.3, Map 35)

***Tofieldia glutinosa* (Michx.) Pers. "false asphodel"**
This species is widely distributed throughout boreal North America with extensions into the temperate zone. It is found from Newfoundland across to southcentral Alaska. Our collections of this species were found in bogs along the Yukon River corridor and they extend the range of this unusual wetland species 190 km northeast of collections made in the Yukon Territory. Other collections made in Alaska are primarily from coastal areas in Wrangell-St. Elias National Park and Preserve, Southeast Alaska, and Prince William Sound. Recent collections, including this one, in interior Alaska have expanded the range of this species into inland areas of Alaska. (Figure 5.3, Map 36)

***Viola renifolia* Gray var. *brainerdii* (Greene) Fern. "kidney-leaved violet"**
This little violet is found in boreal North America from Newfoundland to southcentral Alaska. It is well distributed along the headwaters of the Yukon River and has been collected near Dawson, Yukon Territory. Our collections of this species extend the range of this species 120 km northwest from Dawson. This species is relatively unusual in Alaska and is a new species for the Preserve. (Figure 5.3, Map 37)

***Viola selkirkii* Pursh "great-spurred violet"**
This distinctive violet is found in moist woodlands throughout the circumpolar north. In North America, the species extends from the Aleutian Islands to Newfoundland. The species has many gaps in its distribution especially in Alaska and western Canada where the species is considered rare. It is ranked S3 by the Alaska Natural Heritage Program. Our collection in the Preserve extends the range of this species 370 km to the northeast. (Figure 5.3, Map 38)

Assessment of completeness of inventory of vascular plants of Yukon-Charley Rivers National Preserve

The inventory has greatly increased our understanding of the flora found within the Preserve. Not only has the inventory increased the number of taxa known to the Preserve but it has helped to identify unique and diverse habitats, more fully documented the distribution of taxa, and better established the distribution of rare taxa. Despite the relatively small size of the Preserve (1.02 million hectares) it contains a diverse flora of 631 vascular plant species. In comparison to other parks in central Alaska, Wrangell-St. Elias National Park and Preserve (5.3 million hectares) has reported 832 vascular plant species and Denali National Park and Preserve (2.4 million hectares) has documented the occurrence of 753 vascular plant species.

This vascular plant survey resulted in dramatic increases (51%) in the documented taxa of the Preserve. Despite this major contribution to the understanding of species composition there are two intriguing patterns in the collection data that suggest continued inventory work is warranted for this diverse system: 1) we collected a relatively small percentage (38.7%) of the 271 taxa that were expected to be found and, 2) we collected a large number (122) of taxa that were not expected to be present.

To understand why so few expected species were collected during this inventory one must look carefully at how the list of expected species was generated. The list was based on collections made in the 50 km buffer zone around the Preserve. This strategy likely works well for areas that have roads, rivers and other major access routes that have facilitated botanical collecting; at Yukon-Charley there is very limited access to the Preserve and the surrounding areas. As a result there have been very few major botanical collections in and around the Preserve. Major collections have been largely restricted to easily accessed areas such as Eagle, Dawson, Circle, Circle Hot Springs, and Eagle and Twelve-Mile summits. As a result of the limited collecting in the area the list of expected species may have been somewhat restricted. This is supported by the fact that a large number of the taxa (122) we collected in the Preserve were not expected (Appendix A) to be present. This unexpected collection represented a surprisingly large percentage (53.7%) of the new species we found. Many plant species are known to be disjunct over hundreds of kilometers. Approximately 25% of the unexpected species found in this survey were range extensions (17 major and 4 minor) that were greater than the 50 km buffer zone. A final problem with the expected species list is that the majority of areas in the vicinity that have been surveyed are communities that harbor non-native and invasive

Table 5.3. Occurrences of plant species endemic to Alaska, Yukon Territory and British Columbia found in the three physiographic regions of Yukon-Charley Rivers National Preserve. Taxa with localities shown as "na" were collected prior to the 2002 field season and were not available in ANCS+ database.

Species	River floodplain	Ogilvie Mountains	Yukon-Tanana Uplands	Total # regions present
Antennaria friesiana ssp. *alaskana*			1	1
Antennaria monocephala ssp. *monocephala*				na
Artemisia alaskana	1		1	2
Astragalus williamsii	1			1
Boykinia richardsonii		1	1	2
Campanula aurita	1			1
Carex microchaeta ssp. *microchaeta*				na
Claytonia scammaniana			1	1
Corydalis sempervirens				na
Douglasia arctica		1		1
Douglasia gormanii		1	1	2
Draba murrayi		1	1	2
Draba ogilviensis		1		1
Draba palanderiana		1	1	2
Dryas alaskensis		1	1	2
Elymus alaskanus ssp. *alaskanus*				na
Erigeron hyperboreus		1		1
Erigeron yukonensis				na
Eriogonum flavum var. *aquilinum*				na
Erysimum asperum var. *angustatum*				na
Montia bostockii			1	1
Oxytropis huddelsonii			1	1
Oxytropis scammaniana		1	1	2
Papaver mcconnellii		1	1	2
Papaver nudicaule	1	1	1	3
Penstemon gormani				na
Phacelia mollis	1		1	2
Phacelia sericea		1		1
Poa porsildii		1	1	2
Podistera yukonensis				na
Polygonum alaskanum		1	1	2
Puccinellia interior			1	1
Saxifraga reflexa		1	1	2
Saxifraga spicata		1	1	2
Senecio ogotorukensis		1		1
Senecio yukonensis		1	1	2
Silene williamsii			1	1
Smelowskia borealis		1		1
Synthyris borealis		1	1	2

Table 5.4. Occurrences of Amphiberingean endemic taxa found within Yukon-Charley Rivers National Preserve. Taxa with localities shown as "na" were collected prior to the 2002 field season and were not available in ANCS+ database.

Species	River floodplain	Ogilvie Mountains	Yukon-Tanana Uplands	Total # regions present
Aconitum delphinifolium	1	1	1	3
Anemone multiceps				na
Antennaria monocephala ssp. *monocephala*				na
Arnica griscomii ssp. *frigida*		1		1
Arnica lessingii		1	1	2
Astragalus umbellatus		1	1	2
Cardamine purpurea		1	1	2
Carex lugens			1	1
Carex microchaeta		1		1
Carex microchaeta ssp. *nesophila*				
Castilleja caudata	1		1	2
Castilleja hyperborea		1	1	2
Chrysosplenium wrightii			1	1
Claytonia sarmentosa		1	1	2
Claytonia tuberosa		1	1	2
Cnidium cnidiifolium	1		1	2
Delphinium brachycentrum			1	1
Dodecatheon frigidum		1	1	2
Draba stenopetala			1	1
Elymus macrourus			1	1
Eritrichium aretoides		1	1	2
Festuca brevissima			1	1
Festuca lenensis		1		1
Geum glaciale		1		1
Lagotis glauca		1	1	2
Luzula rufescens				
Luzula tundricola			1	1
Minuartia elegans				
Minuartia yukonensis			1	1
Oxytropis borealis var. *borealis*		1		1
Oxytropis campestris ssp. *jordalii*		1		1
Oxytropis mertensiana			1	1
Papaver macounii		1	1	2
Phlox sibirica		1		1
Podistera macounii		1	1	2
Polygonum bistorta var. *plumosum*		1		1
Potentilla biflora				
Primula eximia		1	1	2
Salix phlebophylla		1	1	2
Salix pulchra	1	1	1	3
Saxifraga calycina			1	1
Saxifraga davurica		1	1	2

Table 5.4 (continued). Occurrences of Amphiberingean endemic taxa found within Yukon-Charley Rivers National Preserve. Taxa with localities shown as "na" were collected prior to the 2002 field season and were not available in ANCS+ database.

Species	River floodplain	Ogilvie Mountains	Yukon-Tanana Uplands	Total # regions present
Saxifraga eschscholtzii		1		1
Saxifraga serpyllifolia			1	1
Selaginella sibirica		1	1	2
Senecio kjellmanii			1	1
Spiraea stevenii		1	1	2
Stellaria dicranoides		1	1	2
Taraxacum alaskanum		1	1	2
Taraxacum kamtschaticum			1	1
Wilhelmsia physodes	1		1	2

Ogilvie Mountains (32 species) and the Yukon-Tanana Uplands (41 species), are quite similar.

The paucity of both Alaska-Yukon and Amphiberingian endemic species in the river floodplain may simply be a result of landscape age. The river floodplain within Yukon-Charley corresponds with the floodplain of the Yukon River and its major tributaries, a heavily disturbed area. The landscape adjacent to the river is relatively young as a result of the continuous migration of the Yukon across its narrow floodplain whereas the mountainous regions of the Preserve tend to be older landscapes. Relatively little (3%-5%) of the Preserve was glaciated during the late Pleistocene so these old mountainous areas experienced relatively little disturbance in recent times and as such seem to support far more endemic plant species than the disturbed river floodplain. Surprisingly, there is little difference in the numbers of element occurrences in the two mountainous regions; however, less that half (47%) of the species have distributions that overlap. The discrete differences in species distribution between the two areas largely accounts for the high number of endemic species within the Preserve as a whole.

Notable collections and range extensions vouchered during the 2002 vascular plant inventory

A number of plant species were collected during this inventory that proved to be notable for a variety of reasons. Element occurrences of these plant species are presented in Appendix C. A plant was considered noteworthy if one of the following applied: the new locality represented a significant range extension, the species is ranked as rare (S3 or less) by the Alaska Natural Heritage Program or the species was collected from a significantly different new locale in the Preserve.

Range extensions discussed in this report are based solely on the literature published to date on distribution patterns of Alaskan plant species. The publications referenced for this work include Eric Hultén's extensive work, *Flora of Alaska and Neighboring Territories (*Hultén 1968); William Cody's work on the *Flora of the Yukon Territory;* Porsild's *Vascular Plants of the Continental Northwest Territories, Canada* (Porsild and Cody 1980); and a monograph published by Cook and Roland (2002) in the Canadian Field-Naturalist, "Notable vascular plants from Alaska in Wrangell-St. Elias National Park and Preserve with comments on floristics."

During this plant inventory we collected voucher specimens that document major range extensions for 19 vascular plant species and minor range extensions for 20 species (Table 5.5). Major range extensions extend the published range of a species 200 km or more whereas a minor range extension extended the range from 70 to 199 km.

Sixty percent of the major and minor range extensions were wetland species found along the Yukon and Charley river corridors. In general, wetland ecosystems have been poorly surveyed in Alaska. It stands to reason that our largest leaps in understanding the distribution of plants in this Preserve have come from surveying wetland ecosystems.

Table 5.5: Range extensions for vascular plant taxa documented by collections made during Floristic Inventory of Yukon-Charley Rivers National Preserve (2002). Bold type indicates range extensions >200 km; normal type indicates range extensions of 70 – 199 km.

Taxa	Physiographic Region	Range Extension*	Description of range extension documented for taxon in Yukon-Charley Rivers National Preserve
Armeria maritima ssp. *arctica*	Yukon-Tanana Uplands	175 km to SE	Unusual interior record for coastal plant
Bidens cernua	River floodplain	124 km to SE	Range connection between Upper Yukon and Tanana rivers and single record along Dempster Highway in Yukon Territory, circumpolar with gaps
Carex holostoma	**Yukon-Tanana Uplands**	**220 km to W**	**Most Alaska collections coastal, disjunct collection in Wrangell-St. Elias, rare in Yukon Territory**
Carex interior	**River floodplain**	**500 km to N**	**Closest record in Anchorage for this southern species, also in Denali and Wrangell-St. Elias**
Carex lapponica	Yukon-Tanana Uplands	180 km W and 247 km E	Circumpolar with large gap, also in Denali and Wrangell-St. Elias
Carex viridula	Ogilvie Mtns.	120 km to NE	Many records south of 64 degrees, other Alaska records for Porcupine and Tanana river drainages, southeastern Alaska, Wrangell-St. Elias, and Denali
Ceratophyllum demersum	River floodplain	172 km to NE	Range connection between Mayo, Yukon Territory, and Ft. Yukon records, also in Wrangell-St. Elias and Denali
Cicuta bulbifera	**River floodplain**	**390 km to NW**	**Closest record from Mayo in Yukon Territory, also in Denali**
Draba ogilviensis	Ogilvie Mtns.	100 km to NW	Endemic to Ogilvie, St. Elias and Mackenzie mountains
Glyceria pulchella	River floodplain	170 to E	Other Alaska collections from central Alaska, Wrangell-St. Elias and Denali
Heracleum lanatum	**Ogilvie Mtns.**	**220 km to NE**	**Closest record near Delta Junction, widely distributed in southern and Southeastern Alaska**
Hippuris montana	**River floodplain**	**300 km to NE**	**Largely coastal species, also in Wrangell-St. Elias**
Impatiens noli-tangere	**River floodplain**	**230 km to NE**	**Closest record from near Fairbanks, also in Wrangell-St. Elias**
Koenigia islandica	**River floodplain**	**200 km to NE**	**Widely distributed in Alaska and Yukon Territory south of 65 degrees, on Northwest coast of Alaska, and in East Asia**
Lycopus uniflorus	**Yukon-Tanana Uplands**	**300 km to NE**	**Closest record from disjunct population near Manley Hot Springs, also in Southeast Alaska**
Malaxis paludosa	**River floodplain**	**500 km to NE**	**Closest record from Anchorage area, also in Denali**
Montia fontana	**Yukon-Tanana Uplands**	**400 km NE**	**Closest locality on Arctic coast, nearly all Alaska records coastal, also in Denali and Wrangell-St. Elias**
Najas flexilis	River floodplain	70 km S	Important record for new addition to list of rare Alaska flora, widespread across North America and in northwestern Europe
Oxytropis arctica	**Ogilvie Mtns.**	**310 km SE**	**Previous records for Arctic coast and plain, Seward Peninsula**
Pedicularis macrodonta	**River floodplain**	**220 km NE**	**Previous record south of Tanana River, also in Wrangell-St. Elias**

Table 5.5 (continued). Range extensions for vascular plant taxa documented by collections during Floristic Inventory of Yukon-Charley Rivers National Preserve (2002). Bold type indicates range extensions >200 km; normal type indicates range extensions of 70 – 199 km.

Potamogeton epihydrus	**River floodplain**	**520 km NE**	**Closest record from Anchorage area, other Alaska records from coastal areas and along Kuskokwim River**
Potamogeton foliosus	River floodplain	140 km NW	Closest record from near Eagle, found across North America, few records for Alaska
Potamogeton friesii	River floodplain	140 km SE	Closest record from near Fort Yukon, also in Wrangell-St. Elias and Denali
Potamogeton natans	Boreal, Yukon-Tanana Uplands	140 km NE	Primarily coastal species with a few southcentral Alaska records
Potamogeton obtusifolius	**River floodplain**	**600 km NE**	**One published record from Canol Rd in Yukon Territory, Amphiatlantic species, also in Denali and Wrangell-St. Elias**
Potamogeton zosteriformis	River floodplain	150 km SE	Extends range from Fort Yukon, also in Denali and Wrangell-St. Elias
Ranunculus macounii	River floodplain	150 km SE	Closest record from below Circle
Rumex acetosa* ssp. *alpestris	**Yukon-Tanana Uplands**	**250 km E**	**Many records for western Alaska and eastern Asia, rare in Yukon Territory, present in British Columbia, Saskatchewan**
Sagittaria cuneata	**River floodplain**	**200 km ESE**	**From Beaver, scattered records for Alaska east of 150 degrees longitude**
Salix candida	River floodplain	70 km SE	Range connection from Circle to Mayo, Yukon Territory, AK range limited to Alaska east of 150 degrees longitude
Salix commutata	**River floodplain**	**230 km NE**	**From Tanana River, most northern record, also in Wrangell-St. Elias**
Saxifraga spicata	Ogilvie Mtns., Yukon-Tanana Uplands	100 km NE	Extends range from Dawson, Yukon Territory, also reported for central and southwest Alaska, Denali
Scheuchzeria palustris	**River floodplain**	**320 km WNW**	**Extends range from near Mayo, Yukon Territory, circumpolar with large gaps**
Scirpus validus	River floodplain	180 km NW	Range connection between Beaver, Alaska, and Ogilvie River, Yukon Territory, widespread in southern Yukon Territory, few records for western Alaska
Sinapis arvensis	Yukon-Tanana Uplands	190 km NW	Introduced weed, common across North America and Europe, not reported for Wrangell-St. Elias or Denali
Tofieldia glutinosa	River floodplain	190 km NE	Extends range from previous Alaska records on Tanana River, other records for Prince William Sound, southeast Alaska, Wrangell-St. Elias
Veronica scutellata	River floodplain	70 km NE	Extends range from Tanana Uplands to Yukon River, rare in Alaska
Viola renifolia	River floodplain Ogilvie Mtns.	120 km NW	Closest record near Dawson, Yukon Territory, rare in AK, reported from Anchorage area
Viola selkirkii	**Ogilvie Mtns**.	**370 km NE**	**Closest record from Rock Creek in Denali**

***Range extensions were estimated by measuring the distance from the nearest published collection locality and noting the general direction in which the range was extended.**

The survey also identified unknown bluff communities along Copper Creek and the Diamond Fork of the Seventymile River. These sites provided new localities for bluff species known only from the Yukon and Charley Rivers. These results verify the need to more fully explore other smaller watersheds in the Preserve where small pockets of unusual plants might be growing.

Below we briefly describe each of the notable species and explain its significance to this plant inventory. A species presented here represents either a significant range extension or a new locale for a rare plant species.

***Armeria maritima* (Mill.) Willd. ssp. *arctica* (Cham.) Hult. "thrift"**
This species is Amphiberingian in its distribution and is generally restricted to the Arctic and Pacific coastlines where it is common. The species is rarely seen inland and our collections represent a 174 km range extension to the southeast. (Plate 5.12; Figure 5.3, Map 1)

***Bidens cernua* L. "nodding beggarticks"**
This circumpolar composite is distributed in weedy habitats throughout North America from Nova Scotia to British Columbia with a disjunct population in interior Alaska. Few collections have been documented in Alaska for this species. Our collections along the Yukon River corridor extend the range of this species, newly documented in the Preserve, 124 km to the southeast. (Plate 5.13 and 5.14; Figure 5.3, Map 2)

***Cardamine digitata* Richards "bitter cress"**
This Amphiberingian species is commonly found in barren ground along the Arctic coast from Siberia to Hudson Bay. The specimens collected in this survey do not significantly extend the range of this species but are interesting in that the specimens establish the southern most edge of the range for this species. (Figure 5.3, Map 3)

***Carex holostoma* Drej.**
This circumpolar sedge is considered rare (S2) by the Alaska Natural Heritage Program. In North America, its distribution extends from Greenland to Alaska along the Arctic Coast with many substantial gaps including major gaps in the Yukon Territory and a disjunct collection in Wrangell-St. Elias National Park and Preserve. The two collections from this study were from the Yukon-Tanana Uplands and extend the published range 220 km west. (Figure 5.3, Map 4)

***Carex interior* Bailey**
This species is rarely found in Alaska and is ranked as S1 (G5) by the Alaska Natural Heritage Program. The range of this North American species extends from Newfoundland across and into the southern portion of Alaska, and south into New Mexico and Virginia. This is a major range extension (500 km) northward from collections made in Anchorage, Denali National Park and Preserve, and Wrangell-St. Elias National Park and Preserve. (Figure 5.3, Map 5)

Plate 5.12. *Armeria maritima* was collected from the vicinity of Mount Sorenson. The collection represents a 175 km range extension. Photograph by M. B. Cook.

Plate 5.13. *Bidens cernua*, a circumpolar species whose collection in Yukon-Charley represents a 127 km range extension. Photograph by A. Larsen.

Plate 5.14. *Bidens cernua* habitat. Photograph by M. B. Cook.

***Carex lapponica* O.F. Lang**
This sedge is rare in Alaska (S2 Alaska Natural Heritage Program) and central and northern Yukon Territory. The range of this species is not well understood. Major gaps in its distribution still persist. Our collection from the upper Charley River watershed extends the known range 180 km to the west. (Figure 5.3, Map 6)

***Carex viridula* Michx. "greenish sedge"**
This sedge is a circumpolar species found in North America from Newfoundland to eastern Alaska. Our single collection from the Crescent Creek drainage extends the range of this species 120 km to the northeast. This is the first time this sedge has been collected within the Preserve boundaries. (Plate 5.15; Figure 5.3, Map 7)

***Ceratophyllum demersum* L. "hornwort"**
This circumpolar aquatic plant is considered rare (S2) by the Alaska Natural Heritage Program. Major gaps in the distribution of this species occur in Alaska and Yukon Territory. Our collection 172 km to the northeast of Fort Yukon, Alaska, connects the range of this species to collections in Mayo, Yukon Territory. (Figure 5.3, Map 8)

***Cicuta bulbifera* L. "water hemlock"**
This wetland umbel is distributed across boreal North America and extends south to Florida and north to the Mackenzie River Valley and central Yukon Territory. The species is ranked S1 (critically imperiled) by the Alaska Natural Heritage Program. We made several collections of this rare species during the 2002 plant inventory. These collections extend the range 390 km northwest of published records of this species. (Plate 5.16; Figure 5.3, Map 9)

***Draba ogilviensis* Hult.**
This tiny mustard is endemic to the western Mackenzie, Ogilvie, and St. Elias mountains of Alaska and the Yukon Territory. This species is ranked S1 (critically imperiled) by the Alaska Natural Heritage Program. Our collections in the Ogilvie Mountains extend the range of this species 100 km to the northwest. (Plate 5.17; Figure 5.3, Map 10)

***Glyceria pulchella* (Nash) Schum. "manna grass"**
This tall wetland grass is found throughout boreal North America from Manitoba to central Alaska. This species is ranked S2S3 by the Alaska Natural Heritage Program. Our collections along the Yukon River corridor extend the range of this species 170 km to the east. (Figure 5.3, Map 11)

***Heracleum lanatum* Michx. "cow parsnip"**
This robust umbel has an Amphiberingian distribution and its range extends from East Asia across North America to Newfoundland. This species is very common along most of its range. Our collection in the Ogilvie Mountains extends the range of this species 220 km to the northeast. (Figure 5.3, Map 12)

***Hippuris montana* Ledeb. "mare's tail"**
This inconspicuous plant is distributed throughout northwestern North America from the Aleutian Islands across southern Alaska to Washington. The plant is generally found along alpine streams and mossy banks. Because of its small nature it is easily overlooked. Our collections extend the range of the species 300 km northeast of collections in Wrangell-St. Elias National Park and Preserve. (Figure 5.3, Map 13)

***Impatiens noli-tangere* L. "touch-me-not"**
This incompletely circumpolar species is distributed across the boreal zone of Europe and North America where extensive gaps in the distribution occur throughout Alaska and Canada. Our collections extend the range of this species 230 km to the northeast from the Fairbanks area in central Alaska. (Figure 5.3, Map 14)

***Koenigia islandica* L.**
This easily overlooked buckwheat has a circumpolar distribution with a multitude of gaps including eastern interior Alaska and much of the Yukon Territory. It typically occupies wet barren earth. The three specimens collected in the upper reaches of the Charley River watershed extend the range of this species 207 km to the northeast and help connect the distribution to northwestern British Columbia and Yukon Territory. (Figure 5.3, Map 15)

***Lycopus uniflorus* Michx. "water horehound"**
This is a North American species that is considered rare (S3) in Alaska by the Alaska Natural Heritage Program. This mint is found from Newfoundland to British Columbia, disjunct to Manley Hot Springs in Central Alaska, and disjunct again to East Asia. Four specimens of this species were collected within the Preserve, all from the river floodplain along the Yukon River corridor. These collections extend the range 300 km to the northeast. (Figure 5.3, Map 16)

***Malaxis paludosa* (L.) Sw. "adder's mouth"**
This diminutive orchid has a very patchy circumpolar distribution with extensive gaps in Alaska and Canada. This orchid is often overlooked because of its small size and its favored habitat, sphagnum bogs, is rarely surveyed. It is ranked S2S3 by the Alaska Natural Heritage Program. This species is new to the Preserve and this collection extends the range of this taxa 500 km to the northeast from the Anchorage area. (Figure 5.3, Map 17)

***Montia fontana* L. "water blinks"**
In North America this circumpolar species has been found from Alaska to Greenland primarily near the Arctic and Pacific coastlines. As its common name implies, it inhabits wet springy places. Our single collection was from the upper portion of the Charley River watershed and extends the range of this species 400 km to the northeast. (Plate 5.18; Figure 5.3, Map 18)

Incompletely circumpolar — 14.6% (7 taxa)

Circumpolar — 8.3% (5 taxa)

Amphiatlantic — 4.2% (2 taxa)

There are several differences between the biogeographic affinities of the rare component of the flora of the Yukon-Charley Rivers National Preserve as compared to that of the total flora of the Preserve (Table 5.2). First and most important are the four-fold increase in the percentage of Alaska-Yukon endemic species and the two-fold increase in the percentage of North American species in the rare component. We also observed significant decreases in the percentage of circumpolar (from 31.2% to 8.3%) and Amphiberingian (from 23.3% to 10.4%) elements found within the rare flora. The North American flora is an important component of the rare flora of Alaska because few of the North American species have distribution patterns that extend into Alaska and if they do extend into Alaska the distribution extends through the northern extension of the Rocky Mountains or the Coast Range. It is likely that the Preserve supports many of these species simply because of its geographic position and overlap with the migratory corridor that existed between Beringia and North America during the Pleistocene.

Distribution of endemic flora within Yukon-Charley Rivers National Preserve

Thirty-nine Alaska-Yukon endemic species have been collected within the Preserve boundaries (Table 5.3). Fourteen of the species were restricted to a single physiographic region and 16 were more broadly distributed. Distribution information was not available for the remaining seven species because they were not collected during the 2002 plant inventory nor were they present in the ANCS+ database for the Preserve. There were 20 species occurrences in the Ogilvie Mountains area, 22 in the Yukon-Tanana Uplands, and only five endemic plant species occurred in the river floodplain. The number of endemic taxa found in the Preserve is high in comparison to other parks in Alaska; Wrangell-St. Elias National Park and Preserve reports only 19 endemic plant species.

The plant species endemic to Beringia include those species that are distributed on both sides of the Bering Strait and restricted to the land area known as Beringia. In Yukon-Charley, there are 51 taxa that fit this definition (Table 5.4). This is a relatively high number for the size of the Preserve and is comparable to Denali National Park and Preserve which has 52 Amphiberingian endemics and covers nearly 3 times the acreage. The Preserve is entirely contained within the eastern portion of Beringia. This area was largely unglaciated during the Pleistocene whereas large portions of Denali National Park and Preserve were glaciated during the Pleistocene so it stands to reason that Yukon-Charley would support a larger number of species endemic to Amphiberingia. The Amphiberingian endemic taxa are unevenly distributed among the physiographic regions of the Preserve. Much like the Alaska-Yukon endemic species, the fewest element occurrences are in the river floodplain, with 6 species; the elemental occurrences in the

Plate 5. 8. *Primula eximia*, a large-flowered Amphiberingian species found in both the Ogilvie Mountains and the Yukon-Tanana Uplands. Photograph by M. B. Cook.

Plate 5.9. *Salix phlebophylla*, an Amphiberingian endemic predominant in alpine areas of the Preserve. Photograph by C. Roland.

Plate 5.10. *Lesquerella caldera*, a rare plant species found in alpine areas in the Ogilvie Mountains. Photograph by C. Roland.

Plate 5.11. On the left is *Douglasia arctica* and on the right *Stellaria dicranoides*, two rare plant species found in the alpine regions of the Preserve. Photograph by M. B. Cook.

Table 5.2. Occurrences of rare plant taxa among the three physiographic regions of Yukon-Charley Rivers National Preserve. Taxa records with localities shown as "na" were collected prior to the 2002 field season and were not available in ANCS+ database.

Species	Global rank*	State rank **	River floodplain	Ogilvie Mountains	Yukon Tanana Upland	Total # regions present
Antennaria densifolia	G3	S1S2		1		1
Campanula aurita	G3G4	S3	1			1
Carex atratiformis	G5	S2				na
Carex crawfordii	G5	S2s3	1			1
Carex eburnea	G5	S2S3				na
Carex holostoma	G4	S2			1	1
Carex interior	G5	S1	1			1
Carex lapponica	G4G5Q	S2			1	1
Ceratophyllum demersum	G5	S2	1			1
Cicuta bulbifera	G5	S1S2	1			1
Corispermum ochotense	G3G4T2?Q	S3				na
Cryptantha shackletteana	G1Q	S1				na
Cryptogramma stelleri	G5	S2S3			1	1
Douglasia arctica	G3	S2S3		1		1
Douglasia gormanii	G3	S3		1	1	2
Draba densifolia	G5	S1			1	1
Draba murrayi	G2	S2		1	1	2
Draba ogilviensis	G2	S1		1		1
Draba praealta	G5	S1S3			na	na
Eriogonum flavum	G5t2	S2				na
Eriophorum viridi-carinatum	G5	S2				na
Erysimum asperum var. *angustatum*	G5t2	S1S2				na
Festuca lenensis	G4	S3		1		1
Glyceria pulchella	G5	S2S3	1			1
Lesquerella calderi	G3	S1S2		1		1
Lycopus uniflorus	G5	S3	1			1
Malaxis paludosa	G4	S2S3	1			1
Minuartia biflora	G5	S2			1	1
Minuartia yukonensis	G3G4	S3			1	1
Montia bostockii	G3	S3			1	1
Myriophyllum verticillatum	G5	S3	1		1	2
Najas flexilis	G5	S1S2	1			1
Oxytropis huddelsonii	G3	S2S3			1	1
Pedicularis macrodonta	G4Q	S3	1			1
Phacelia mollis	G2	S2S3	1		1	2
Phacelia sericea	G5	S2		1		1
Phlox hoodii	G5	S1S2				na
Poa porsildii	G3	S2		1	1	2
Podistera yukonensis	G2	S1		1		1
Potamogeton obtusifolius	G5	S1	1			1
Ranunculus glacialis ssp. *chamissonis*	G4T3T4	S2			1	1
Ranunculus turneri	G2G3q	S1		1		1
Salix candida	G5	S2S3	1			1

Table 5.2 (cont'd). Occurrences of rare plant taxa among the three physiographic regions of Yukon-Charley Rivers National Preserve. Taxa records with localities shown as "na" were collected prior to the 2002 field season and were not available in ANCS+ database.

Species	Global rank*	State rank **	River floodplain	Ogilvie Mountains	Yukon-Tanana Uplands	Total # regions present
Scheuchzeria palustris	G5T5	S3	1			1
Smilacina stellata	G5	S2				na
Stellaria dicranoides	G3	S3		1	1	2
Stellaria umbellata	G5	S2S3			1	1
Tanacetum bipinnatum ssp. *huronense*	G5T4T5	S3	1			1
Viola selkirkii	G5	S3		1		1

*Species Global Ranks (Copyright 1998, University of Alaska Anchorage)

- G1: Critically imperiled globally.
- G2: Imperiled globally.
- G3: Rare or uncommon globally.
- G4: Apparently secure globally, but cause for long-term concern.
- G5: Demonstrably secure globally.
- G?: Unranked.
- G#G#: Global rank of species uncertain, best described as a range between the two ranks.
- G#Q: Taxonomically questionable.
- G#T#: Global rank of species and global rank of the described variety or subspecies of the species.

**Species State Rankings (Copyright 1998, University of Alaska Anchorage)

- S1: Critically imperiled in state.
- S2: Imperiled in state.
- S3: Rare or uncommon in state.
- S4: Apparently secure in state, but with cause for long-term concern.
- S5: Demonstrably secure in state.
- S#S#: State rank of species uncertain, best described as a range between the two ranks.

Table 5.1. Number of sites visited in each of the ecological subsections in Yukon-Charley Rivers National Preserve.

Ecological Subsections	Number of Sites Visited
Yukon River Valley	56
Upper Charley Mountain Tundra	28
Ogilvie Lime-Dolostone Mountains	18
Three Fingers Subalpine Basin	10
Upper Charley Valleys	10
Biederman Hills	7
Ogilvie Foothills	5
Charley Foothills	1
Hard Luck Lowland	0
Kandik Tableland	0
Little Black River Hills	0
Snowy Domes	0
Thanksgiving Loess Plain	0
Tintina Hills	0

Taxa new to the flora of Yukon-Charley Rivers National Preserve

A total of 2519 specimens were collected during the 2002 inventory representing 551 species and 27 subspecies. Of those collected, 12 families, 43 genera, 210 species and 17 subspecies were newly documented for the Preserve (Appendix A). This collection, combined with the 421 species and 26 subspecies previously documented in the Preserve, brings the total number of species known for the Preserve to 631; including the 43 subspecies there are 674 taxa (Appendix B). The 2002 vascular plant inventory resulted in a 51% increase in documented taxa within the Preserve.

Compared to other parks in interior Alaska, Yukon-Charley has high species richness, particularly when you consider the relatively small size of the Preserve. Denali National Park and Preserve, approximately 3 times the size of Yukon-Charley, has documented 753 species (816 taxa) and Wrangell-St. Elias, a Park and Preserve more than 5 times the size of Yukon-Charley, has documented 832 species (887 taxa).

The flora of the Preserve is distributed among 74 families and 218 genera. The most species-rich plant families represented are Cyperaceae with 73 species (78 taxa), Asteraceae with 56 species (62 taxa), Poaceae with 46 species (53 taxa) and Brassicaceae with 40 species (42 taxa). These are also the most species-rich plant families in both Denali and Wrangell-St. Elias national parks.

Growth form composition of the flora

The species composition of the vascular plant flora of Yukon-Charley Rivers National Preserve is dominated by herbaceous life forms and characterized by the paucity of species with woody growth forms such as shrubs and trees (Figure 5.1). Here, trees represented less than one percent of the plant species, shrubs comprised approximately 5%, and dwarf shrubs a mere 3%. Although trees and shrubs represent a small number of

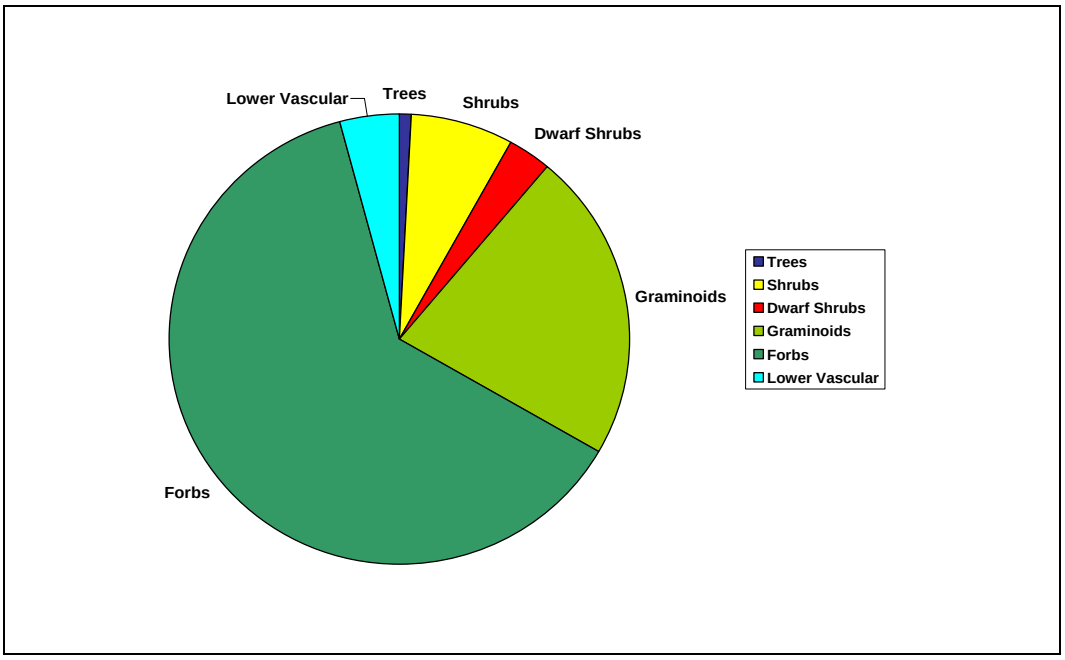

Figure 5.1. Percentage of vascular plant species in each of eight growth form categories documented to occur in Yukon-Charley Rivers National Preserve.

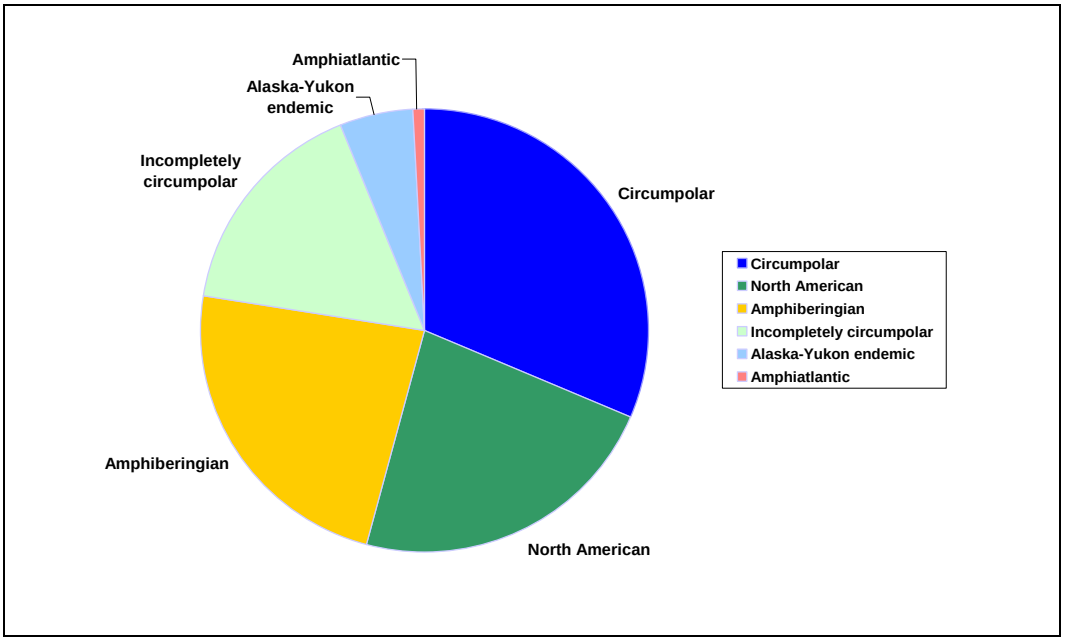

Figure 5.2. Percentage of vascular plant taxa in each of six biogeographic categories that predominate in Yukon-Charley Rivers National Preserve.

the species present they are dominant species in lower elevation sites. Life forms such as graminoids (grass-like species) and forbs comprised a much larger percentage, 22% and 62% respectively, of the taxonomic composition of the flora (Plate 5.1) and tended to be dominant in wetlands and higher elevation sites. The lower vascular plants represented only 4% of the vascular plant species in the Preserve.

Biogeography of the flora of Yukon-Charley Rivers National Preserve

Yukon-Charley Rivers National Preserve lies in eastern interior Alaska adjacent to the border with Canada. The Preserve contains a diverse collection of plant species that have origins in geographically disparate areas including Europe, Asia, and North America. The high species diversity is likely due to the overlap in distribution patterns of the major North American floristic elements including common boreal forest plants, arctic and alpine species, as well as species endemic to Alaska, the Yukon and Beringia (Figure 5.2).

We recognized the following floristic elements in the Preserve flora:

Circumpolar species — 31.4% (212 taxa)
This group includes broadly distributed plant species that occur on all polar land masses including both Asiatic and European regions of Eurasia, Greenland and North America (Plate 5.2). We further divided this group of plants into boreal species primarily found in lowland and montane habitats and arctic/alpine taxa that generally occur in treeless landscapes in the arctic or alpine regions. A third element of the circumpolar flora is a group of wide-ranging species with broad distributions that occur across both arctic and boreal zones, and a fourth category of the circumpolar species are exotic species introduced from other parts of the world into Alaska. The number of species in these categories within the circumpolar flora and examples of taxa from each category are as follows:

- Arctic-alpine species (80 taxa) – *Potentilla hyparctica* and *Thalictrum alpinum*
- Boreal-montane species (44 taxa) – *Calla palustris* and *Linnea borealis*
- Cordilleran species (1 taxa) – *Rumex acetosa* ssp. *alpestris*
- Widespread species (77 taxa) – *Calamagrostis stricta* and *Lloydia serotina*
- Introduced species (10 taxa) – *Polygonum aviculare* and *Plantago major*

Incompletely circumpolar species — 16.4% (111 taxa)
The species in this group have distributions that are similar to the circumpolar plants of boreal distribution, but are not known from either Greenland or Europe, and thus have geographic ranges that are not truly circumpolar.

- Arctic-alpine species (13 taxa) – *Myosotis alpestris* and *Campanula uniflora*
- Boreal-montane species (50 taxa) – *Adoxa moschatelliana* and *Bidens cernua*
- Widespread species (45 species) – *Petasites frigidus* and *Carex chordorrhiza*
- Disjunct species (3 species) – *Carex lasiocarpa* and *Nymphaea tetragona*

Plate 5.1. A mesic meadow dominated by forbs and graminoids. Over 60% of the species found in Yukon Charley are herbaceous forbs. Photograph by C. Roland.

Plate 5.2. *Potentilla uniflora*, a common circumpolar species found in the Ogilvie Mountains. Photograph by A. Larsen.

Plate 5.3. This close-up photograph shows the flower of the delicate *Primula mistassinica*, a North American species. Photograph by A. Larsen.

Plate 5.4. Mesic meadow in the Ogilvie Mountains. The dominant species is *Primula mistassinica*. Photograph by A. Larsen.

North American species — 22.5% (152 taxa)
Taxa in this group have distributions that are generally restricted to the North American continent (Plates 5.3 and 5.4). Two additional groups of species with more restricted distributions can be identified within the North American element: Cordilleran species, which occur in the western mountains, and Pacific coastal species which are generally restricted to the coastal ranges and the west coast of North America. A third category of disjunct species has a distribution of a few stations in the subarctic but the bulk of their range is in the temperate zone.

- Arctic-alpine species (13 taxa) – *Saxifraga tricuspidata* and *Potentilla virgulata*
- Boreal-montane species (84 taxa) – *Mertensia paniculata* and *Carex concinna*
- Cordilleran species (27 taxa) – *Draba densifolia* and *Nuphar polysepalum*
- Pacific coastal species (4 taxa) – *Hippuris montana* and *Dodecatheon pulchellum*
- Widespread species (19 taxa) – *Scirpus validus* and *Potamogeton epihydrus*
- Disjunct species (5 taxa) – *Carex interior* and *Eriogonum flavum* var. *aquilinum*

Alaska-Yukon endemic species — 5.4% (37 taxa)
These are species that are restricted to Alaska and Yukon Territory, or sometimes extend into neighboring regions of Northwest Territories and British Columbia (Plates 5.5 and 5.6).

- Arctic-alpine species (14 taxa) – *Oxytropis scammaniana* and *Senecio yukonensis*
- Boreal-montane species (12 taxa) – *Saxifraga spicata* and *Draba murrayi*
- Cordilleran species – (10 taxa) – *Oxytropis huddelsonii* and *Puccinellia interior*
- Widespread species– (1 taxa) – *Salix pulchra*

Amphiberingian species — 23.3% (157 taxa)
These are species that occur in North America and northern Asia but are not known from either Greenland or Europe; hence their center of distribution generally lies within Beringia (Plates 5.7, 5.8 and 5.9). We further separate the species within the Amphiberingian biogeographic element into the following categories:

- Arctic-alpine species (86 taxa) – *Oxytropis borealis* and *Arnica lessingii*
- Boreal-montane species (21 taxa) – *Achillea sibirica* and *Silene repens*
- Cordilleran species (1 taxa) – *Anemone multiceps*
- Pacific coastal species (3 taxa) – *Cardamine umbellata*
- North Pacific and Arctic coastal species (2 taxa) – *Draba borealis*
- Widespread species (43 taxa) – *Bupleurum americanum* and *Cerastium beeringianum*
- Disjunct species (1 taxa) – *Chaemorhodos erecta*

Plate 5.5. Many Alaska-Yukon endemic species such as *Draba murrayi* (above) and *Claytonia scammaniana* (Plate 5.6) are found within the Preserve. Photograph by C. Roland.

Plate 5.6. *Claytonia scammaniana* by M. B. Cook.

Plate 5.7. *Eritrichium aretoides*, an Amphiberingian endemic, growing among rocks on Mount Sorenson, one of the tallest peaks in the Yukon-Tanana Uplands. Photograph by C. Roland.

VI. **Amphiatlantic species** — 0.7% (5 taxa) – *Draba crassifolia, Chenopodium capitatum, Carex nardina, Najas flexilis* and *Potamogeton obtusifolius*
Taxa in this group of species have distributions that include North America, Greenland and Europe but are not known from Asia.

Rare Flora of Yukon-Charley Rivers National Preserve

The Preserve has long been recognized as home to a variety of rare plant species many of which are located in the subarctic steppe habitat along the Yukon and Charley rivers. Forty-nine species of plants that have an Alaska Natural Heritage state rank of less than S3 (Table 5.2) have been collected within the Preserve (Plates 5.10 and 5.11). Fifteen of these taxa are considered globally imperiled (G3) by the Alaska Natural Heritage Program. Prior to the 2002 inventory, 30 rare plant species had been collected within the Preserve, eight of which are typically found in subarctic steppe. Numerous studies have been made of this rare plant community (see Batten et al. 1979; Cook et al. 1993; Edwards et al. 1989, 1994; Kassler 1979; Knuckles et al. 1992; Lloyd et al. 1994; Murray et al. 1983; Parker et al. 1995; Parker 1997; Roland 1990, 1991,1996; Wesser 1990; Wesser et al. 1991; and Young 1976). In 2002, 19 additional rare species were collected bringing the Preserve total to 49 species (Table 5.2). Wetland habitats contributed the greatest number of new rare species: 14 species were found in wetlands and the remaining five were collected from alpine and woodland areas. Prior to the 2002 survey, very little effort had been spent surveying wetland ecosystems within the Preserve. The sheer number of rare plants found is very high in comparison to other park areas in Alaska. Wrangell-St. Elias National Park and Preserve, a park encompassing more than 6 times the area in Yukon-Charley, supports 69 rare plant species (Cook and Roland 2002) and Denali National Park and Preserve, also many times larger has documented 52 rare plant species (Roland 2004).

The rare flora found in Yukon-Charley is distributed among 27 families and 36 genera. The two most important families are Cyperaceae and Brassicaceae which represented six and seven taxa respectively. Together they comprise approximately 30% of the rare taxa. The remaining portion of the rare flora is split among 25 families. The rare plant species for which we had locality information are relatively evenly distributed among the three physiographic regions of the Preserve: 26.1% are in the Ogilvie Mountain areas north of the Yukon River, 34.7% occur within the river floodplain along the Yukon River corridor, and approximately 39.2% occur in the Yukon-Tanana Uplands south of the Yukon River.

The biogeographic composition of the rare flora

North American species — 39.6% (19 taxa)

Alaska-Yukon endemics — 22.9% (11 taxa)

Amphiberingean species — 10.4% (5 taxa)

ABSTRACT

During the summer of 2002, we conducted a vascular plant inventory of Yukon-Charley Rivers National Preserve, Alaska, as part of the Biological Inventories for the Natural Resource Challenge. The principal goals of the survey were to produce a voucher-based list of vascular plant species that documents 90% of the species expected to exist within the boundaries of the Preserve and to synthesize all known floristic information on the Preserve. To accomplish these goals the four following objectives were met:

- assemble all existing floristic data into a database;
- assess the strengths and weaknesses of this existing data set and identify geographic and taxonomic gaps in the knowledge of Yukon-Charley Rivers National Preserve's flora;
- target vascular plant inventory fieldwork to effectively fill data gaps and assemble a complete, voucher-based vascular plant list for Yukon-Charley Rivers National Preserve;
- synthesize the results of both historic and new floristic investigations from original field work into a report describing the state of our knowledge concerning the vascular plant floristics of Yukon-Charley Rivers National Preserve.

We spent approximately 820 hours surveying 135 sites across the landscape of Yukon-Charley Rivers National Preserve. We collected and documented over 2500 voucher specimens of which 2137 were prepared as permanent voucher specimens, now housed at the University of Alaska Herbarium.

From the 2002 collection we documented the occurrence of 551 species and 27 subspecies including 227 newly documented taxa (including species and subspecies). This collection brings the total number of species known for the Preserve to 631; including the 43 subspecies known, there are 674 total taxa. We documented 39 range extensions.

The Preserve has long been known as home to a variety of rare and endemic plant species. In 2002, we collected 19 new plant species that are recognized by the Alaska Natural Heritage Program as rare in Alaska, bringing the total number of rare species known for the Preserve to 49. Sixty percent of the 39 range extensions we documented were wetland plants. And 14 of the 19 rare plant species found in the 2002 inventory are wetland plant species. Our greatest contribution to the understanding of the Alaskan flora is our contribution to our knowledge of wetland plant species.

The baseline information provided by this survey of vascular plant species distribution and composition forms a strong foundation upon which the Central Alaska Network of Parks can build a sustainable long term monitoring program. And it outlines some basic gaps in our understanding of the flora of Yukon-Charley Rivers National Preserve.

EXECUTIVE SUMMARY

Chapter One: Introduction

- This report details a vascular plant inventory conducted in 2002 in Yukon-Charley Rivers National Preserve. We focus on synthesizing all floristic information known to date about the vascular plant species composition and known distributions throughout the Preserve.

- The primary goal of the vascular plant inventory of Yukon-Charley Rivers National Preserve was to create a voucher-based species list by combining historic data with data collected during a targeted field survey. This data is to serve as a baseline inventory dataset for a biological monitoring program.

- This study was completed in the four following stages:

    1. assemble all existing floristic data into a database;
    2. assess the strengths and weaknesses of this existing data set and identify geographic and taxonomic gaps in the knowledge of Yukon-Charley Rivers National Preserve's flora;
    3. target vascular plant inventory fieldwork to effectively fill the data gaps and assemble a complete, voucher-based vascular plant flora for Yukon-Charley Rivers National Preserve;
    4. synthesize the results of both existing and new floristic investigations from original field work into a report describing the state of our knowledge concerning the vascular plant floristics of Yukon-Charley Rivers National Preserve.

Chapter Two: Description of Study Area

- Yukon-Charley Rivers National Preserve is located in eastern interior Alaska along the central upper Yukon River. The landscape of the Preserve is a complex mosaic of mountains, hills, river valleys and lowlands all of which dramatically impact habitat complexity for vascular plants. The Preserve was largely unglaciated during the Pleistocene. The ice free area of Yukon-Charley was connected to areas in Eastern Asia; this connection played a critical role in the distribution of vascular plants found in the Preserve.

- Fire is the dominant natural disturbance on the landscape in Yukon-Charley Rivers National Preserve. Fluvial processes and permafrost also play important roles in the distribution of vascular plant species within the Preserve. A strong continental climate prevails throughout the entire Preserve with short warm summers and long very cold winters.

- Taiga, an extensive subarctic forest dominated by conifers and several widespread species of hardwoods, dominates the area. The Preserve contains the most

extensive system of steppe bluffs – steep, south-facing bluffs dominated by semiarid grasses - and also the largest array of endemic and disjunct taxa found anywhere in Alaska.

Chapter Three: History of Plant Collecting

- The Yukon River served, and continues to serve, as the primary route by which botanists have surveyed Yukon-Charley Rivers National Preserve. Botanical collecting in Yukon-Charley began in the late 1800's nearly 100 years before it was designated as a Preserve by the National Park Service. Much of the botanical collecting and floristic research in Yukon-Charley has been concentrated on understanding species composition of the subarctic steppe plant communities that occupy steep south facing bluffs along the major river corridors.

Chapter Four: Methods

- Alaska Natural Heritage Program reviewed all known collections from the Preserve, compiled a list of documented vascular plant species, and generated an expected plant species list that was based on collections from nearby areas. National Park Service botanists performed Gap analysis to identify geographic, ecological and taxonomic gaps in the botanical data set from Yukon-Charley Rivers National Preserve.

- We conducted a targeted survey of vascular plant species within the Preserve by collecting permanent voucher specimens of notable species seen within each sampling site.

- We modified a relational database generated in Wrangell-St. Elias National Park and Preserve for use in this plant inventory. The database was used to track all specimens collected during this inventory, to track species that had been previously accounted for, and to analyze the data generated to synthesize information for this report.

Chapter Five: Summary of Inventory Results

- We spent approximately 820 hours surveying 135 sites for vascular plants in Yukon-Charley Rivers National Preserve. 2137 specimens were prepared as permanent voucher specimens. Among these specimens we identified 551 species and 27 subspecies. We documented 210 species and 17 subspecies that were new to the Preserve. Combined with the 421 species and 26 subspecies previously documented in the Preserve, these new collections bring the total number of species known for the Preserve to 631. Including the 43 subspecies, there are now 674 taxa documented for the Preserve.

- During the 2002 inventory we collected 19 new rare vascular plant species. When combined with the 30 species previously known to the Preserve, they bring the

total number of rare plant species documented in the Preserve to 49. Because of the complex geologic history of the area, a wide variety of endemic plant species are found in the Preserve. There are 39 species endemic to Alaska and Yukon Territory and 51 taxa endemic to Beringia. These numbers are comparable to Denali National Park and Preserve which covers 3 times as much land surface as Yukon-Charley Rivers National Preserve.

- During this 2002 vascular plant inventory we collected voucher specimens that documented major range extensions for 19 vascular plant species and minor range extensions for 20 species. Wetland plant species accounted for significant percentages of the range extensions, rare plant species, and plants considered new to the Preserve.

- The inventory has greatly increased our understanding of the flora found within the Preserve. Not only has the inventory increased the number of taxa known to the Preserve but it has helped to identify unique and diverse habitats, more fully documented the distribution of taxa, and better established the distribution of rare taxa.

- To date we have collected 94% of the number of taxa expected/known to be in the Preserve. This measure of completeness is not without problems. Although the new list of taxa for the Preserve contains nearly 94% of the <u>number</u> of taxa expected, it includes only 77% of the <u>taxa</u> expected.

- The following recommendations are made to reduce the persisting data gaps and improve our understanding of the vascular plant flora in the Preserve: 1) continue surveys in under-surveyed sites and, 2) a careful review of the expected species list. The largest gap in our understanding of the flora persists in the hills on the south side of the Yukon River. Smaller gaps in our understanding of the vascular plant flora also persist in wetland ecosystems.

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Chapter 1 Introduction

In this document we describe the results of the vascular plant inventory conducted at Yukon-Charley Rivers National Preserve in 2002. This work summarizes the inventory conducted in 2002 and a subset of the botanical data known from the Preserve. This work resulted in a 51% increase, from 421 to 631 species, in the known vascular plant flora. The objective of this report is to summarize this one year plant inventory and to synthesize the information known of the resident vascular plant flora.

Yukon-Charley Rivers National Preserve was established in 1980 under the Alaska National Interest Lands Conservation Act (ANILCA, Public Law 96-487). The Preserve was set aside "To maintain the environmental integrity of the entire Charley River Basin, including streams, lakes and other natural features, in its undeveloped natural condition for public benefit and scientific study…" (ANILCA section 201(10), 1980). The Preserve is situated in eastern interior Alaska along the Alaska-Canada border and is located on the original North American continental margin (one of the oldest terrains in Alaska). A nearly complete geological record (Precambrian to present) is represented in the Preserve's rock layers. The complex geology in the area is largely responsible for the diverse array of natural and cultural resources found here and the primary reason this area was selected by the National Park Service for designation.

There are no roads into the Preserve so access is limited to boat or airplane. As a result of the limited access, most botanical work in the Preserve has taken place along the navigable waters. The most significant botanical research conducted in the Preserve has centered around the subarctic steppe plant communities found on steep south-facing bluffs along the Yukon River and its tributaries. Some authors consider these communities modern analogs of past vegetation types that were widespread during the Pleistocene (Kassler 1979, Murray et al. 1983, Young 1982). During the Pleistocene, the Yukon-Charley area was located entirely in the unglaciated refugium known as Beringia; it supported a large assemblage of grazing animals, and was also an important migration route for prehistoric peoples into interior Alaska and the northern temperate zone. The rare and endemic plant populations of the Yukon-Charley region first received attention in the 1960's (Shacklette 1966). In addition, botanical surveys were conducted in various parts of the Preserve as part of fire ecology, land cover, avifauna and rare plant studies. These surveys tended to be small isolated studies that did not assess the overall botanical composition of the Preserve. So, despite the intensive work that has been conducted there are still extensive gaps in our understanding of the flora here.

Steve Young (1976) noted that Yukon-Charley lies within an extremely diverse portion of the far north and that the area supports an array of temperate, boreal and arctic plant species. This is likely due to rich mineral deposits, the complex hydrologic network, and the semi-arid continental climate characteristic of the area. These conditions support frequent fires and discontinuous permafrost that interact over time to form the complex mosaic of vegetation. As a result, the Preserve is a virtual patchwork quilt of plant communities the distributions of which are dependent on a variety of factors. Additionally, the area supports many plant species with varied distributions including

circumpolar species, species endemic to the Cordillera of western North America and Beringia, and a number of species endemic to Yukon and Alaska.

The goal of this one year study was to review past botanical collections made in the Preserve and conduct additional plant surveys in areas that had not been surveyed previously. This would help to synthesize known floristic information and to add to our understanding of the local flora. Additionally, this would provide both resource managers and the I & M Program with baseline information about the flora.

Background and development of Yukon-Charley Rivers National Preserve Floristic Inventory

In 1998, Congress passed the National Parks Omnibus Management Act which mandated the establishment of National Park Service Inventory and Monitoring programs to establish baseline and long term trend information for National Park Service resources. Inventory and Monitoring (I & M) Programs were funded and established for all National Park Service units and these were designed to be administered through multi-park networks. The I & M Program for Yukon-Charley Rivers National Preserve is administered with programs for Wrangell-St. Elias and Denali National Park and Preserve units through the Central Alaska Network (Swanson 2000). As part of the I & M Program, the Biological Inventory Program's goal is to provide comprehensive, scientifically based information about the nature and status of vascular plants and vertebrates occurring within Preserve boundaries. The Vascular Plant Inventory described in this report represents an important part of this program by providing essential baseline information regarding species composition, distribution and limited information on local abundance. This information will be useful in designing a long-term monitoring program within the Central Alaska Network.

This work was initiated in April, 2000 when the NPS Alaska Region held a Biological Inventory Scoping Meeting in Anchorage to develop priorities and explore ways to implement the inventory effort in parks and preserves throughout Alaska. At this meeting, vascular plant species were recognized as a biological resource befitting an extensive biological inventory. Vascular plants were chosen because each park unit staff in the Central Alaska Network (CAKN) identified inventory gaps in vascular plant taxa. An analysis of documented and expected vascular plant species in Yukon-Charley revealed relatively low percentages (65%) of documented taxa despite the intensive efforts of botanists to understand the unique arctic steppe communities the Preserve is known for. Additionally, it was recognized that there was inadequate information about the distribution of rare, endemic and other plant species of special management concern in Yukon-Charley. These data gaps were reviewed with local botanical experts and refined for inclusion into the inventory study plan. Carl Roland, Plant Ecologist for Denali National Park and Preserve, and Mary Beth Cook, Botanist for Wrangell-St. Elias National Park and Preserve, then drafted a network inventory study plan for vascular plants (Roland and Cook in Swanson 2000, p. 13). The plan included a one year study of the vascular flora of Yukon-Charley Rivers National Preserve.

In the early stages of this process, NPS entered a contract agreement with the Alaska Natural Heritage Program (AKNHP). The goal of this work was to compile and verify historical and predicted species data. To accomplish this task AKNHP had four major objectives:

1. Document all vascular plant species that were known to be within the Preserve
2. Produce a list of vascular plant species expected to be within the Preserve
3. Compile supportive evidence on the status of each species and catalog this information in the bibliographic database NRbib
4. And use this information to populate the NPSpecies database.

This work was completed in spring 2002 and was critical to the final planning phase of the field inventory. Final field preparations were completed in late spring just prior to the field inventory that began June 2002.

Objectives

The primary goal of the vascular plant inventory of Yukon-Charley Rivers National Preserve was to create a voucher-based species list by combining existing data with data collected during a targeted field survey. The impetus behind this massive collection effort was to provide an accurate accounting of the species found within the Preserve to the National Inventory and Monitoring Program. This inventory was designed to provide baseline species distribution information that could be used to develop an effective inventory and monitoring program.

A voucher is a physical collection of a taxon combined with a known physical location and collection date. This mode of data collection is superior to other occurrence data in that it represents a permanent physical record that can be reviewed and reclassified if nomenclature or taxonomy changes. To accomplish this we conducted a 3 month survey in which we carefully collected geo-referenced specimens from a diverse array of habitats in each of the physiographic regions. To accomplish this goal these four major objectives needed to be met:

- assemble all existing floristic data into a database;

- assess the strengths and weaknesses of this existing data set and identify geographic and taxonomic gaps in the knowledge of Yukon-Charley Rivers National Preserve's flora;

- target vascular plant inventory fieldwork to effectively fill the data gaps and assemble a complete, voucher-based vascular plant flora for Yukon-Charley Rivers National Preserve;

- synthesize the results of both existing and new floristic investigations from original field work into a report describing the state of our knowledge concerning the vascular plant floristics of Yukon-Charley Rivers National Preserve.

We also sought to:

- document populations of rare plant species and communities;
- determine distributions of plant species that occur within the Preserve, especially for species of special management concern, such as rare and sensitive plant species, endemic species, and species living at the extremes of their distribution;
- describe the taxonomic, ecological and geographic characteristics of selected species of special management concern;
- generate a database that could be used to synthesize existing data and track future floristic investigations.

Funding sources for the Vascular Plant Inventory for Yukon-Charley Rivers National Preserve

The National Park Service Servicewide Inventory and Monitoring Program provided money for support of vascular plant inventory fieldwork in the amount of $90,316 for fiscal year 2002. Of these funds, $34,280 was used for personnel costs to cover the salary for the Principal Investigator. The balance was spent for logistics, aircraft, travel, and archiving. Work on this project was accomplished under the auspices of the Central Alaska Network vascular plant inventory project as part of the National Park Service Inventory and Monitoring Program's Biological Inventories initiative, which was formalized in a study plan for inventory of the flora of the three Central Alaska Network park units (Cook and Roland 2000).

Overview of this report

The goal of this report is to present the results of the 2002 Vascular Plant Inventory fieldwork and to summarize the current state of knowledge about the distribution and composition of the vascular flora of Yukon-Charley Rivers National Preserve. The report includes information from preexisting plant collections as well as the results from fieldwork accomplished during this study.

The report begins with an introduction to the project and its goals (Chapter1). A second section describes the climate, physiography, geology, vegetation, and ecological history of the Yukon-Charley Rivers National Preserve area (Chapter 2), followed by a history of vascular plant collecting in the area (Chapter 3). Chapter 4 defines methods that were used during this reconnaissance floristic inventory. These include site selection, field methods, curation of specimens, and analysis of the resulting data. Chapter 5 provides an overall summary of the results of this project and a discussion about the biogeography of the vascular flora of Yukon-Charley Rivers National Preserve. This chapter presents new records for plant species, range extensions for vascular plant taxa, and the documentation of previously unknown populations of rare plant species within the Preserve**.** An

annotated list and distribution maps for particularly significant taxa collected during the course of this study are provided in Chapter 5. Chapter 5 concludes with an assessment of the degree of completeness of this current vascular plant inventory

Chapter 2 Description of Study Area

The purpose of this chapter is to review the physiographic, climatic, geologic and ecological context in which vascular plants are growing within the bounds of Yukon-Charley Rivers National Preserve. We've chosen to discuss these basic elements because they explain much about the composition and distribution of vascular plants. Over time plants have adapted to living in particular conditions and, as a result, groups of species often occur in predictable patterns. This information combined with key floristic information explains the mosaic of vegetation we often see on the landscape. Understanding these basic elements will help explain the distribution and composition of the vascular plant flora found here.

The Preserve encompasses 1.02 million hectares and contains the mountains and bluffs bordering the Yukon River for a 260 kilometer reach between the towns of Eagle and Circle City, Alaska (Figure 2.1). The landscape of the Preserve is a mosaic of deeply incised uplands drained by five major rivers: Tatonduk, Nation, Kandik, Seventymile and Charley. The Charley River is by far the largest watershed in the Preserve and is contained wholly within its borders.

Throughout most of its length in the Preserve, the Yukon River is bounded on one or both sides by bluffs and mountains that rise rapidly from the floodplain, rising sharply in some areas to 650 meters. In these areas, prominences such as Biederman's Bluff, Woodchopper Canyon, and Kathul Mountain provide rugged and spectacular scenery and have been the object of considerable botanical interest (Young 1976). The most studied of these bluff systems is Kathul Mountain, a broad open south-facing slope that rises abruptly to 900 to 1000 meters elevation. The top of the slope is vegetated by deciduous trees and scrub with exposed areas of dry, stony fell-field. Like other high bluffs along the river, lower, steeper slopes support a sparse tree-less vegetation dominated by grasses, sedges and forbs (Young 1976). This subarctic steppe has a high number of endemic, disjunct, and rare vascular plant species. The small size, limited range, unique composition, and possible ancient affiliation of these arid communities make them the subject of critical botanical concern.

Along the rest of its length, the land rises fairly gently from the Yukon River to both the north and south (Young 1976). To the north of the river, the land extends to the headwaters of a number of creeks and rivers that drain into the Porcupine River. The Tatonduk, Nation, and Kandik rivers also flow into the Yukon from the north. The Tatonduk watershed includes several of the highest limestone peaks and ridges of the western Ogilvie Mountains, while the Kandik flows out of low hills at the northwesternmost extent of this range (Roland 1996).

To the south of the river, rolling forest and muskeg-covered hills rise slowly for 15 to 30 kilometers to reach an elevation of 300 to1000 meters before giving way to a rugged mountainous province. The expansive Charley River enters the Yukon from the south. The Charley River watershed consists of a mountainous terrain that contains several

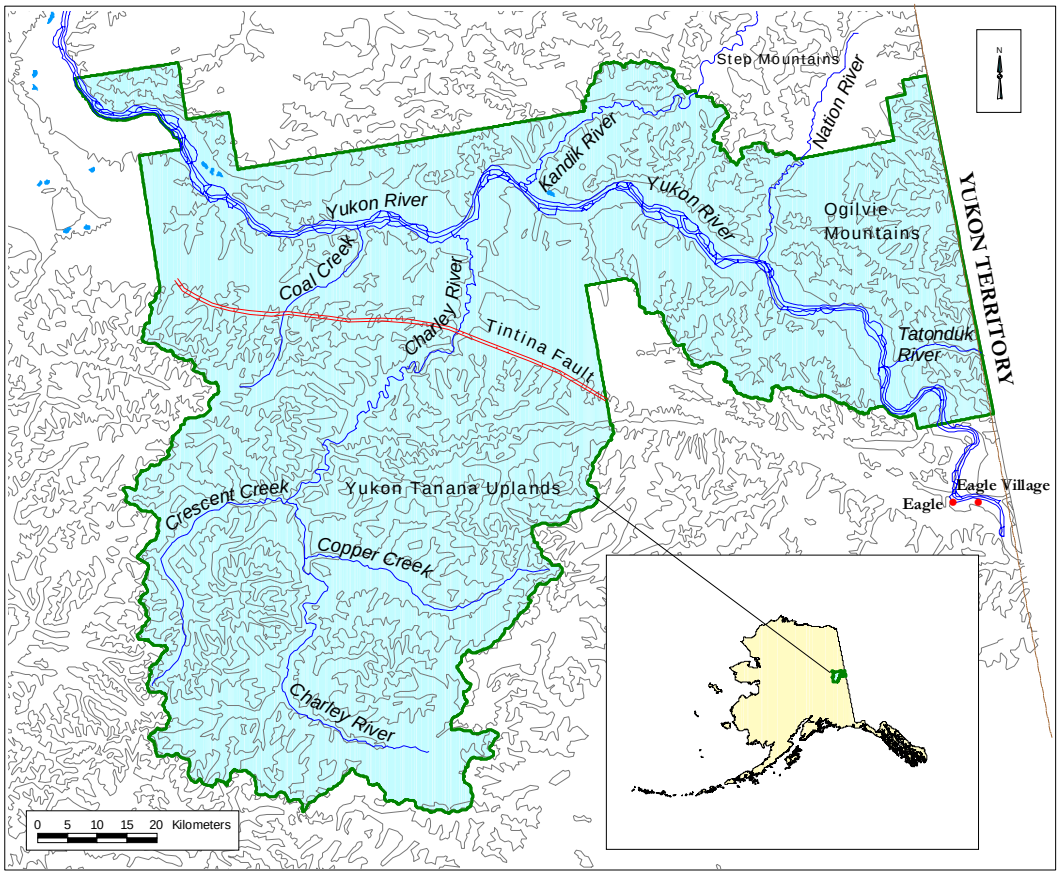

Figure 2.1. Major features of the landscape of Yukon-Charley Rivers National Preserve located in eastern interior Alaska. Note that the 610 meter (2000 foot) contour intervals are indicated. (Mercator Projection, NAD 1927)

peaks over 2000 meters, some of the highest and most rugged terrain between the Alaska Range to the south and the Brooks Range to the north. This mountain district is deeply incised and drained by a complex of creeks and rivers. Timberline generally occurs at 1000 to 1300 meters, although some valleys are vegetated by alpine tundra and brush as low as 600 meters. Land at the highest elevations is mainly fell-field and rock desert, with pockets of tundra vegetation in hollows and solifluction lobes (waterlogged thawed surface layers that slip downhill across frozen permafrost subsoils) (Roland 1996).

Although there is evidence of alpine glaciation (cirques, headwalls, talus slopes and knife-edge ridges) in the mountains of the headwaters of the Charley River, there are currently no glaciers and only a few patches of permanent ice. The few high-elevation lakes to be found in the Upper Charley River district are less than 1000 meters in length (Young 1976).

The Tintina Fault is a major transform fault that runs southeast to northwest from Watson Lake, Yukon, across the Preserve to Fort Yukon, Alaska. The fault is a defining element of the geology of the area largely because a massive trench, called the Tintina Trench, has developed over the past 200 million years where the two land surfaces have been laterally displaced. In the Preserve, the Tintina Fault runs 10-20 kilometers south of and parallel to the Yukon River (Figure 2.1). The land to the north of the fault is relatively stable while the land to the south of the fault has moved an estimated 420 kilometers to the northwest (Roddick 1967). This massive fault divides the Preserve into two major ecoregions (Figure 2.2) by separating the metamorphic rock units of the Yukon-Tanana Uplands to the south of the river from the relatively unmetamorphosed sediments in the Ogilvie Mountains to the north (Rodick 1967, Roland 1996). The Preserve also contains a small portion of the Yukon-Old Crow Basin ecoregion, a shallow gently sloping basin that contains vast wetlands (Figure 2.2).

Physiography

The shape of the landscape has long been considered a driving force behind the distribution of vascular plants; slope, aspect, elevation and the composition of the underlying geology interact to influence growth defining conditions at a specific site. It's these unique characteristics that determine the species composition at any given locale. The landscape of the Preserve is a complex mosaic of mountains, hills, river valleys and lowlands all of which dramatically impact habitat complexity. Below we briefly describe the major physiographic features that dominate this complex landscape.

Mountains

Yukon-Charley Rivers National Preserve contains two major mountain ranges - the Yukon-Tanana Uplands and the Ogilvie Mountains - and a series of foothills. These two mountain ranges are separated by the Tintina Fault.

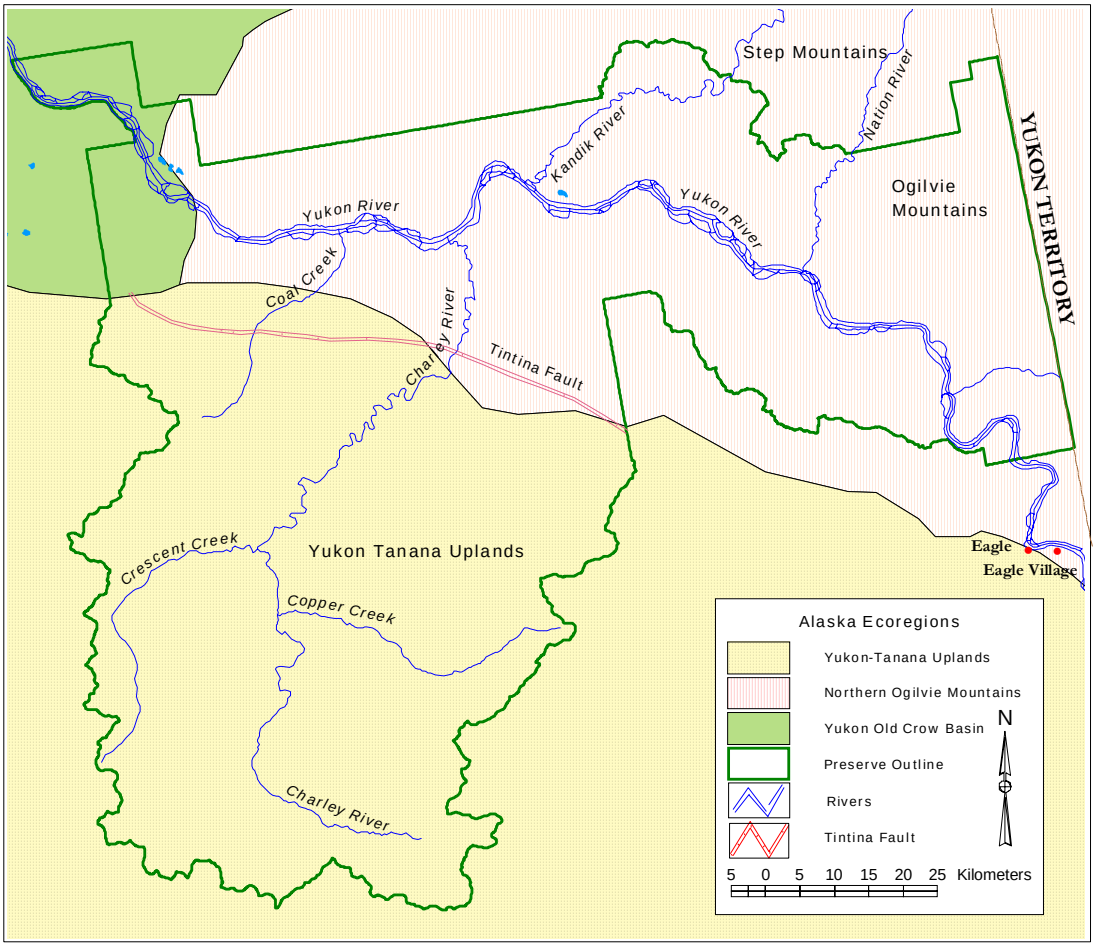

Figure 2.2. Three major ecoregions that have been identified for Yukon-Charley Rivers National Preserve. (Mercator Projection, NAD 1927)

Yukon-Tanana Uplands:
The Yukon-Tanana Uplands (Plate 2.1) are characterized by broad, rounded mountains of moderate height (Nowacki et al. 2002). The terrain is fairly uniform and is comprised of meta-sedimentary rock composed of both former volcanic island arcs and continental shelf deposits. Most surfaces are comprised of bedrock and coarse rubble on ridges, colluvium on lower slopes, and alluvium in the deeply incised valleys. The region is underlain by discontinuous permafrost on north-facing slopes and valley bottoms (Swanson 1999).

Evidence of small alpine glaciers in the upper portions of the Charley River watershed is quite common. However, there are presently no glaciers within the Preserve and few permanent snowfields remain. In the upper watersheds of the Charley and Seventymile rivers, the mountains rise dramatically with rugged peaks reaching 2000 meters.

Ogilvie Mountains:
Sedimentary rock, especially limestone, underlies the majority of the Northern Ogilvie Mountains (Swanson 1999, Plate 2.2). The terrain is characterized by flat-topped hills with barren ridgetops and upper slopes that have undergone long periods of erosion. Frost-shattered rock outcrops with extensive scree slopes, characteristic of an unglaciated area that has undergone long periods of erosion, dominate the area. Under low lying areas, characterized as the eroded remnants of a former plain, soil is deeper and is underlain by extensive permafrost.

Hills

A series of hills forms the interface between the Yukon River and the mountain ranges. Major hills within the Preserve include: the Tintina, Little Black River, Biederman, and Charley River hills and the Ogilvie foothills (Plate 2.3). These sites include steep south facing bluffs composed of sedimentary and volcanic rock; gentle forested hills composed of Paleozoic and other sedimentary rocks; and gentle forested hills composed of soft sandstone, mudstone and conglomerate. Hills abut the north and south sides of the Yukon River and are sandwiched between the two major mountain ranges.

Lowlands

Lowlands within the Preserve are largely confined to the Yukon River floodplain. Along much of its length through the Preserve, the Yukon is bounded by bluffs and mountains that rise from sea level. The relatively confined nature of the Yukon River through this stretch has minimized the area in which lowlands have formed. Typically, lowlands here form where the river has meandered across its floodplain leaving sloughs and oxbow lakes. In older areas underlain by permafrost, thaw ponds have formed where the permafrost has eroded. The extent of lowland habitat is largely limited to small isolated patches on one riverbank or the other. The one exception to this is Andrew Creek Flats, a fairly extensive wetland complex that is just downstream from the mouth of the Charley River (Plate 2.4). Virtually all of the lowlands within the Preserve occur in the Northern Ogilvie Mountains ecoregion.

Plate 2.1 West Fork of the Charley River shows the characteristic shape of the mountains that predominate in the Yukon-Tanana Upland. Photograph by A. Larsen

Plate 2.2 The Ogilvie Mountains are found in the northeast section of the Preserve. These limestone mountains support a unique suite of endemic taxa. Photograph by C. Roland

Plate 2.3. Hills comprise slightly more than 40% of the landscape of Yukon-Charley Rivers National Preserve. The Little Black River Hills shown here are in the northwestern most portion of the Preserve. Photograph by A. Larsen.

Plate 2.4 Portion of the Andrew Creek Flats, a large lowland composed of streams, muskeg and shallow lakes. Photograph by A. Larsen.

A small subset of lowlands in the northeastern-most section of the Preserve lies in the Yukon Old Crow Basin, an extensive lowland area that rings the Old Crow and Yukon Flats. These gently sloping basins drain into the Porcupine River. The surfaces surrounding the flats are largely unglaciated and products of millions of years of weathering of surrounding mountains, forming deep deposits of colluvial, alluvial and eolian origin. This area is underlain by large continuous masses of permafrost, where vast wetlands dominate the area with dense concentrations of thaw ponds (Swanson 1999). This physiographic region makes up a very small portion, only 44,000 ha, 4 %, of the Preserve.

Rivers

Yukon River:
At 3200 km in length, the Yukon River (Plate 2.5) ranks as the third longest river in North America. It originates in the coastal mountains above Atlin, British Columbia, and travels northwest through the Yukon Territory. It crosses the international boundary near the town of Eagle, Alaska, just outside of Yukon-Charley Rivers National Preserve. Throughout its 260 km stretch within the Preserve, it is a low gradient glacial river, turbid from its load of suspended particles. It is deeply channelized and confined throughout this section but just outside the Preserve boundary, near the town of Circle, the main channel divides into a large number of channels, creating a complex of bars, islands and cutoff lakes. In some sections of the Yukon within the Preserve, the riverbed shifts, creating new mud and silt flats that are colonized by disturbance-tolerant species such as *Plantago major*, *Epilobium latifolium* and *Polygonum* species. The river rises and falls some three to six meters during the course of a year creating bands of periodically inundated terrain along its banks.

Charley River:
The full drainage of the 171 km long Charley River (Plate 2.7) as it flows from its headwaters on the Yukon-Tanana Uplands to its mouth at the Yukon River is contained within the Preserve. Its headwaters drain the north side of the peaks dividing the Charley, Fortymile and Salcha watersheds, flowing northeast through the mountainous terrain of the Charley River Mountains. The channel of the Charley River is generally deeply incised, undercutting bands of steep and rocky bluffs that rise from the narrow valley floor. This high gradient clear water river flows through beds of highly metamorphosed units of mica-schist, gneiss, adamyllite and phyllite (Brabb et al. 1969).

Kandik River:
The Kandik River (Plate 2.6) drains the northeastern corner of the Preserve. It flows 132 km to the southwest from its headwaters in the Ogilvie Mountains in the Yukon Territory to its end on the north side of the Yukon River between Kathul Mountain and Biederman Bluff. This is the westernmost drainage in the Ogilvie Mountains. The Kandik is a slow moving, widely meandering stream that occupies a wide valley flanked by low hills. The terrain is mostly gentle and rolling. The valley floor is overlain by extensive alluvial terraces occupied by *Picea mariana* muskegs in low-lying areas and closed *Picea glauca* forest on well-drained slopes. The north-facing slopes of the valleys support open

Plate 2.5. The Yukon River is the fifth largest river in North America. The large glacial river is deeply entrenched over the 260 km stretch that lies within the Preserve. Photograph by D. Person.

Plate 2.6. Large gravel bar on the Kandik River. Photograph by A. Larsen.

Plate 2.7 Section of the 171 km long Charley River. This high gradient river flows through the entire Yukon-Tanana Uplands region that predominates in the southern section of the Preserve. Photograph by C. Roland.

Small islands of grassy, treeless vegetation occur in localities with high proportions of bare ground and dry soils (Plate 2.19). In the Preserve, these conditions prevail on steep, dry, south facing slopes where ecological conditions are unsuitable for the establishment of forest. Here vegetation is dominated by drought tolerant shrubs such as sagebrush (*Artemisia frigida* and *alaskana*), wild rose (*Rosa acicularis*) and juniper *(Juniperus communis*) mixed with perennial grasses (*Calamagrostis purpurascens* and *Agropyron spicatum*) and forbs (*Solidago* sp., *Galium* sp. and *Pulsatilla* sp.).

More importantly, these droughty sites, both steppe grasslands and nearby rubble slopes and slide areas, are home to several narrowly endemic plant species restricted to a few sites or populations. Four species: *Cryptantha shackletteana, Draba murrayi, Eriogonum flavum* and *Podistera yukonensis* are candidates for protection under the Endangered Species Act. Other rare plants associated with subarctic steppe are *Erysimum asperum, Papaver nudicaule, Phacelia sericea* and *Phacelia mollis* (Murray et al. 1983). The apparent inability of these subarctic steppe plant communities to compete for light in mesic localities occupied by boreal forest appears to have restricted them to these islands of warm, well-drained habitat in a sea of tundra, bog and taiga. The Preserve contains the most extensive system of steppe bluffs and also the largest array of endemic and disjunct taxa found anywhere in Alaska (Murray et al. 1983). Roland (1996) suggests these bluffs support the greatest concentration of rare and endemic taxa of any plant association in Alaska.

These distinctive steppe plant communities have intrigued biologists for 40 years. Many plant ecologists have sought to explain their occurrence here and in their other disjunct locations. Shacklette (1966) first reported these rare plant communities on Eagle Bluff outside Eagle, Alaska. He proposed that the high rate of endemism among species at this site was the result of their unusual tolerance of phytotoxic elements (barium, nickel and zinc) found in high levels in these soils giving them a competitive edge over otherwise more aggressive species. His theory was soon disproved when similar soils were found supporting various other plant communities in other sites. Ensuing studies suggested that the species' ability to withstand arid conditions at these sites enabled them to out-compete zonal species (Wesser et al. 1991, Wesser 1990, Edwards et al. 1989, Murray et al. 1983, Batten et al. 1979, Young 1976). With discoveries of additional populations along the system of bluffs in the upper Yukon River valley, a unique botanical province was revealed. This province could be characterized by: a small group of narrowly endemic taxa, disjunct from the dry interior of north Asia, growing in isolated populations of disjuncts from temperate steppe areas of continental North America (Roland 1996).

Researchers offered several hypotheses for the distribution of these disjunct populations in eastern central Alaska. Most intriguing was the suggestion that these could be relict populations from Pleistocene Beringia, a time when the area was apparently characterized by a cold, arid, tree-less steppe comparable to what is found in these small disjunct populations on warm south-facing bluffs today (Yurtsev 1984a, Murray et al. 1983, Kassler 1979, Young 1976). Researchers offered two pieces of evidence to support this connection: first, paleontological studies show that the herb-rich pollen assemblage found

Plate 2.18. Low growing alpine tundra that is characteristic of the Yukon Tanana Upland. Photograph by C. Roland.

Plate 2.19. Subarctic steppe is found along the Yukon and Charley rivers. This habitat supports a unique community of plants. Photograph by C. Roland.

in late Pleistocene sediments is quite similar to what is found on south-facing bluffs today; and second, the specific floristic similarity of vegetation in two distant areas of the Beringian refugium that today share an extremely continental climate and are separated by environments inimical to exchange or dispersion (Murray et al. 1983).

More recent research, Roland (1996), suggests that the disjunct and endemic species of the subarctic steppe offer a window into the biogeographic history of the area. Changes in microclimate, competition among plants, and successional change during the Holocene have likely lead to local extinctions and changes in community composition in steppe communities. As a result the modern steppe communities may not reflect the exact species composition of vegetation found during the glacial maximum. Even if intact communities didn't survive, the treeless areas of large bluffs do accommodate Amphiberingian taxa with ranges that have been fragmented by the expansion of forest and shrub tundra across the landscape of Alaska and the Russian Far-East during the Holocene (Roland 1996).

Although most research has focused on the rare and endemic species characteristic of these subarctic steppe populations, in fact, some of the rarest of the rare species found in the Preserve are unique to Alaska and are probably North American in origin. Their closest relatives are found in the Rocky Mountains and Intermountain West. These taxa include the endemics *Papaver nudicaule* ssp. *americanum*, *Penstemon gormanii*, *Phacelia mollis*, *Podistera yukonensis*, *Erysimum asperum* var. *angustatum* and the disjunct *Phacelia sericea* (Murray in Parker 1995, p. v.)

Exotic Taxa

Several investigators have made note of the exotic plant species that have become established in the Preserve. Young (1976) observed a relatively large number of weedy species that seem to have become permanently established along muddy, disturbed shores and bars of the Yukon River, below the high water mark. A few of these species are considered to be introduced, such as *Polygonum aviculare*, *P. achoreum*, and *Plantago major*. It is possible that the naturally disturbed situations resulting from the periodic flooding of the Yukon provide an opportunity for the migration of these adventive species, which otherwise would probably be confined only to inhabited areas (Young 1976). In 2002, the National Park Service contracted with the Geological Survey to conduct an exotic plant inventory around the developed areas in the Preserve. They identified six exotic species, *Achillea millefolium*, *Chenopodium album*, *Matricaria discoidea*, *Plantago major*, *Taraxacum officinale*, and *Tripleurospermum inordorum*, during their studies. *Plantago* was found in disturbed sites throughout the Preserve; other taxa had fairly spotty distributions. *Tripleurospermum*, a fairly new species for Alaska, was reported just once (Chris McKee, personal communication, 2004).

Aquatic and Wetland Ecosystems

To date very little research has been conducted in the extensive wetland ecosystems that occupy lowlands in the Yukon River corridor. Steve Young (1976) noted the high

diversity of wetland ecosystems dispersed throughout the Yukon River and the lower reaches of the major tributaries (Nation, Kandik, Charley and Tatonduk rivers). After Young's explorations in the Preserve he postulated that any new major floristic discoveries would be found in these wetland ecosystems. Although the Preserve is relatively small, there are a large number of shallow lake ecosystems that lie within the river corridors; 870 lakes are found within the Preserve. Generally speaking the lakes in the Preserve are small; over 806 lakes (92%) are less than five hectares in size. The lakes here are predominately shallow with extensive littoral zones and as a result tend to support extensive beds of mudflat annual, emergent and submergent plant species (Plates 2.20 through 2.24). Young (1976) also noted the high diversity of wetland ecosystems found within the Preserve including bogs, marshes, oxbows, and ephemeral lakes. Additionally, there are a large number of seeps and ephemeral streams in the alpine zone and extensive riparian areas. Due to the sheer number and diversity of lakes and the high variation among sites within Yukon-Charley, wetland ecosystems were a large target for the vascular plant inventory. The need for an intensive survey was first recognized by Young (1976) over 25 years ago when he indicated the need for inventory and collection efforts in wetland areas. This inventory, at long last, addresses this need to investigate plant populations beyond the rivers edge and, especially, to inventory wetland habitats.

Ecological subsections

In 1999, the NPS I & M Program provided funding to develop a baseline ecological map. The map synthesized remotely-sensed data to define regions of relatively uniform ecological conditions (vegetation, landforms, hydrology and soils) as 14 ecological subsections and, on a finer scale, as 30 detailed ecological units, all in GIS format. Data was synthesized from high-altitude infrared aerial photos, USGS geologic maps and Ducks Unlimited land cover maps (Figure 2.10; Swanson 1999).

The ecological subsections of the Preserve divide sharply along the Tintina Fault, the defining element in the geology of the area. Nine of the fourteen subsections occur to the north of the fault; four occur in the Yukon-Tanana Uplands, south of the Tintina Fault. One, the Yukon River Valley, straddles the line (Figure 2.10). The large number of ecological subsections, along with the absence of a single dominant subsection, characterizing the Preserve helps to explain the rich diversity of plant species found here. A similar ecological mapping effort in the three times as large area in Denali National Park and Preserve reported a total of 23 subsections, only 60% more than the 14 occurring in Yukon Charley. The ecological diversity is particularly noteworthy in the ancient landscape north of the fault where nine of the subsections are found. When the detailed ecoregion units were aggregated based on earth cover type, they found the following: regions represented as hills made up the largest surface area (41%), followed by mountain valleys (14%), mountain tundra (14%), floodplains and low terraces (9%), lowlands (8%), and river bluffs (1%) (Swanson 1999).

Plate 2.20. Wet sedge meadows frequently surround boreal lakes in the Preserve. Photograph by A. Larsen.

Plate 2.21. This diminutive buttercup, *Ranunculus gmelini*, grows on the mudflats of a shallow lake in Andrew Creek Flats. Photograph by A. Larsen.

Plate 2.22. *Polygonum amphibium* was found growing in shallow wetlands throughout the wetlands along the Yukon River. Photograph by M. B. Cook

Plate 2.23. *Nuphar polysepalum*, a large floating-leaved plant that grows in closed lakes in the Preserve. Photograph by A. Larsen.

Plate 2.24. Leaves and over-wintering bodies of *Utricularia vulgaris*, a carnivorous plant of wetlands in the Preserve. Photograph by J. Lawler.

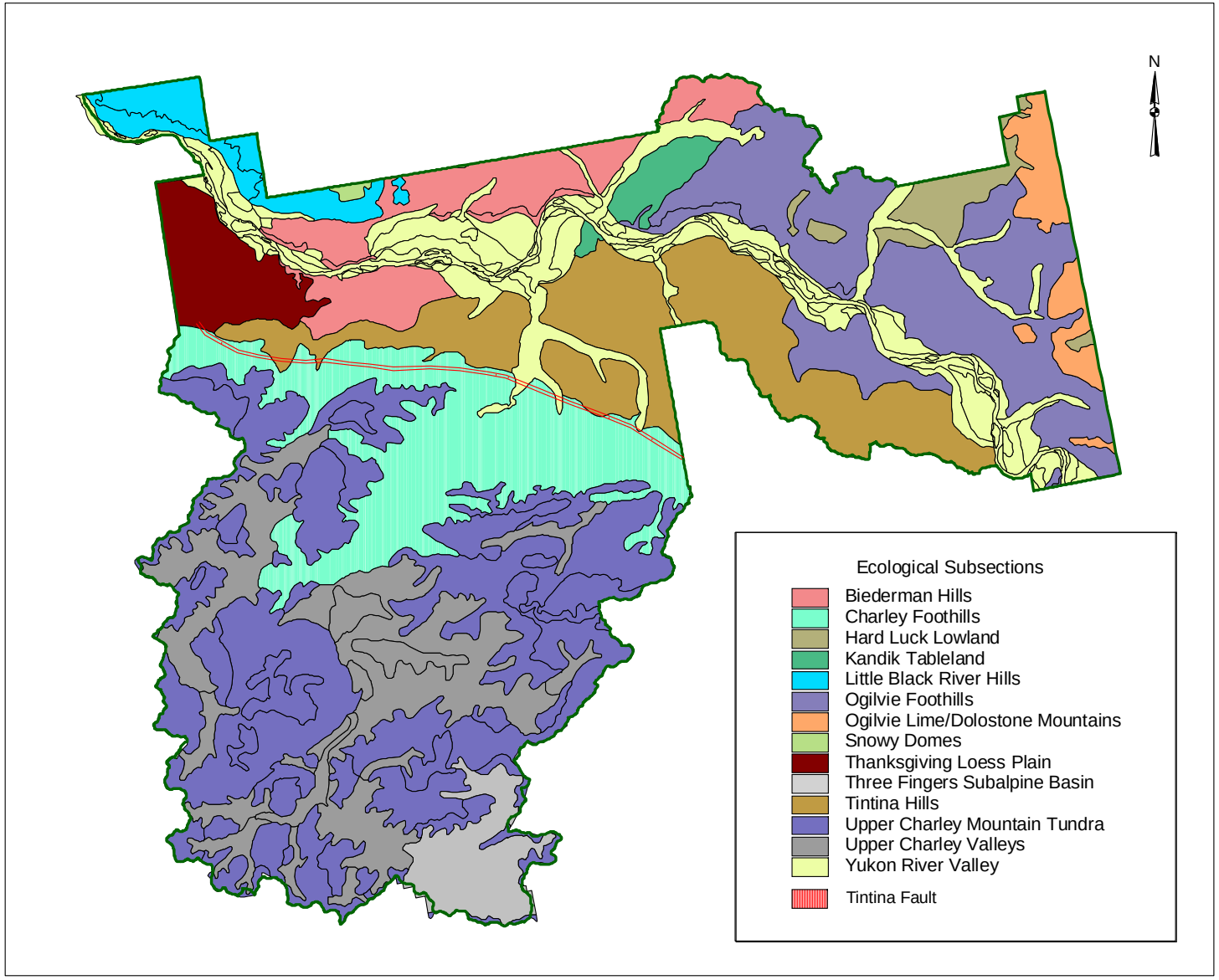

Figure 2.10 Fourteen ecological subsections have been defined for Yukon-Charley Rivers National Preserve. (Mercator Projection, NAD 1927)

muskeg; south-facing sites have mixed *Betula resinifera* and *Picea glauca* forest (Roland 1996).

Tatonduk River:
The Tatonduk River has its headwaters in the high peaks of the western Ogilvie Mountains from which it flows 97 km to its end in the Yukon River. The gradient is steep, and the fast-flowing river passes through steep and rugged terrain. Large limestone bluffs and cliffs rise from the floodplain of the river along much of its length and connect to ridges ascending into alpine areas of the Ogilvie Mountains (Roland 1996).

Nation River:
The Nation River (Plate 2.8) originates in the Ogilvie Mountains in the Yukon Territory and flows 80 km southwestward until it empties into the Yukon River. The gradient is gentle and the river follows a single meandering channel. Landcover types are primarily needleleaf forest (white and black spruce), wet herbaceous (grasses), and lichens (low and dwarf shrubs). The geology consists primarily of Precambrian limestone and granite, Paleozoic chert and igneous rocks, and Cenozoic sandstone and mudstone (Young 1976).

Physiographic Regions

For the purposes of this report and to more closely evaluate the distribution patterns of the flora within the Preserve we divided the Preserve into three basic regions that we felt best represented the three major physiographic regions (Figure 2.3). We expected species composition to differ among these regions because of different underlying geology, physiography, and climate. We simply used the Yukon River and its floodplain as a mechanism to divide the Preserve. Using this technique we identified the three following physiographic regions: 1) the river floodplain which consisted of the floodplain of the Yukon River and its primary tributaries; 2) the Ogilvie Mountains which consisted of all the bluffs, hills and mountains north of the river floodplain; and 3) the Yukon-Tanana Upland which consisted of all the bluffs, hills and mountains south of the river floodplain (Figure 2.3).

Geological History

In Alaska, the character of the landscape has been shaped by the tectonic and glacial histories of the area. Geologists theorize that most of Alaska is made up of foreign terranes attached to the ancestral North American continental plate. The landscape of Yukon-Charley is unique in that land lying north of the Tintina Fault rests on the ancestral continental plate itself. Although this plate underlies most of northern and central Yukon Territory, it only occurs in this small area in Alaska. The geology of this ancestral plate is a complex of interbedded siltstone, mudstone and conglomerates of Pliocene origin alternating with exposures of lower Cretaceous argillite, greywacke, and shale. The Ogilvie Mountains are composed of older dolomite, shale and limestone units (Foster 1976, Plate 2.9).

Plate 2.8. The Nation River meets the Yukon River. The Nation drains large sections of the Ogilvie Mountains. NPS file photograph.

Plate 2.9. Slopes covered with shattered limestone that predominates in the Ogilvie Mountains. Photograph by C. Roland.

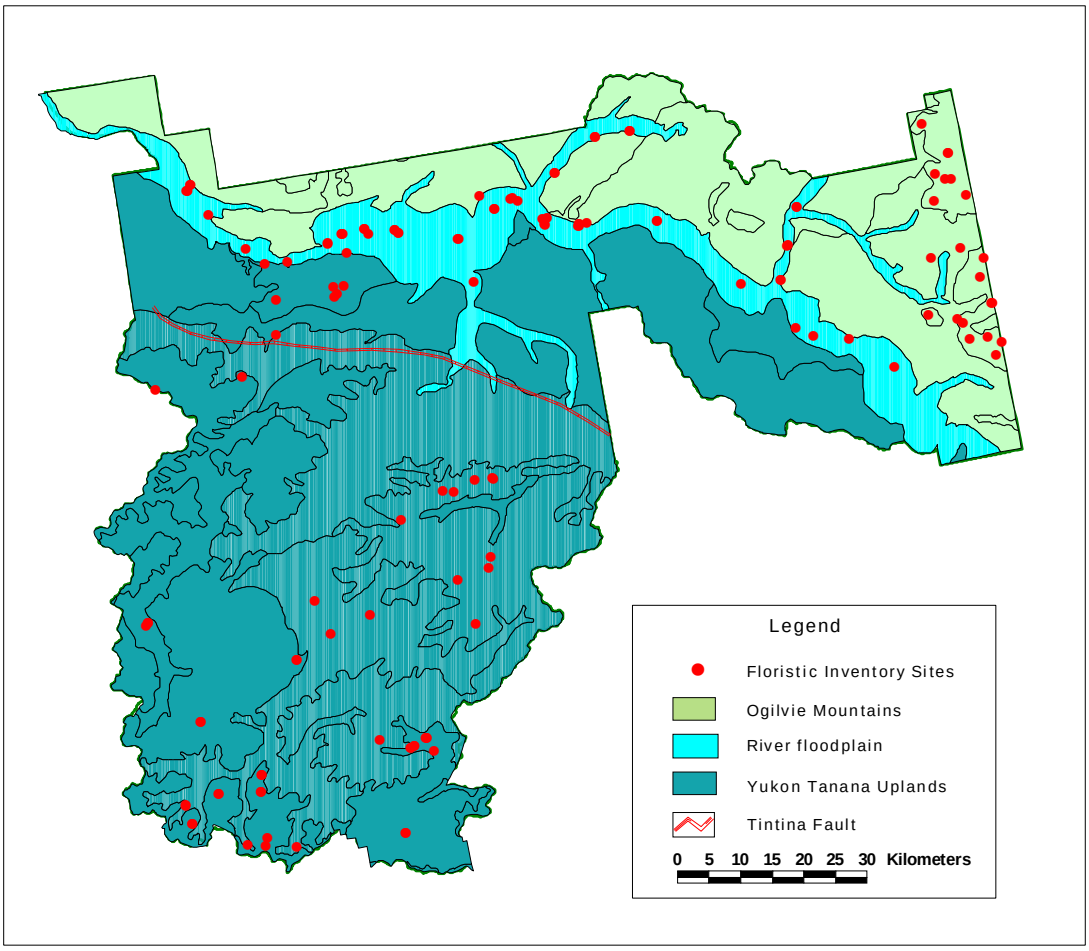

Figure 2.3. Three physiographic regions of Yukon-Charley Rivers National Preserve. (Mercator Projection, NAD 1927)

The rugged Yukon-Tanana Upland, which lies to the south of the Tintina fault, is a much younger landscape. It rests on an accreted terrane composed of uplifted coastal sediments and volcanic arc islands. The main rock type is of igneous origin: metamorphic gneiss, mica-schist, phyllite, and related strata. A large pluton, believed to be Mesozoic in origin, blankets much of the region. Valley floors are primarily composed of sand, gravel and silt that have eroded from the surrounding mountains (Foster 1976).

Glacial History

During the Pleistocene Epoch, a period beginning 1.6 million years ago and ending 10 thousand years ago, the landscape surrounding the Yukon was further shaped by a series of glaciations. During this time, up to 50% of Alaska's landscape was buried beneath a thick, continental ice sheet (Hamilton et al. 1986). Valleys were filled with thousands of feet of ice, leaving only the tops of mountains exposed. Only the north slope of Alaska and the interior lowlands of Alaska and the Yukon Territory (including most of the area of Yukon-Charley Rivers National Preserve) were spared this glaciation (Figure 2.4). In the highlands of the Yukon-Tanana Uplands, drift evidence suggests that maximum glaciation consisted of several hundred cirque and valley glaciers covering approximately 20% of the uplands (Figure 2.5, Weber 1986). Evidence of glaciation can be seen in the cirques in the highlands and U-shaped valleys below (Plates 2.10 and 2.11). No glaciers are present today and no perennial snowbanks have been observed.

During the maximum Pleistocene glaciation, approximately 25,000 years ago, this ice-free landscape of the interior lowlands was intermittently connected through an ice-free corridor to a comparable area in Eastern Asia. As the climate cooled and water was tied up in the major ice sheets, sea level dropped and exposed the continental shelf beneath the Bering Sea, forming a land bridge between North America and Asia (Figure 2.6). This Bering Land Bridge created a contiguous ice-free land mass, called Beringia, which stretched from the banks of the Mackenzie River in Canada to the banks of the Lena River in Siberia and formed an unglaciated corridor between the massive ice sheets created during Quaternary glacial advances. Beringia remained intact until about 15.5 thousand years ago when the rising sea first breached the Bering Land Bridge, the temporary link between North America and Asia, re-opening the Bering Strait (Hopkins 1982). During its ice-free period, this bridge persisted as a peninsula of Asia and provided a migratory connection between Eurasia and North America. Much research has been conducted in the Preserve to establish floristic relationships between vegetation in Eastern Asia and vegetation within the Preserve (Murray in Parker et al. 1995).

In addition to the Beringian ice-free corridor, evidence suggests a second corridor opened periodically during the Wisconsin Glaciation along the east flank of the Rocky Mountains between the Laurentian and Cordilleran ice sheets. This corridor connected Beringia with the unglaciated lands south of the North American ice sheets. This is thought to have provided an important migratory corridor between North America and Eurasia for plants and wildlife.

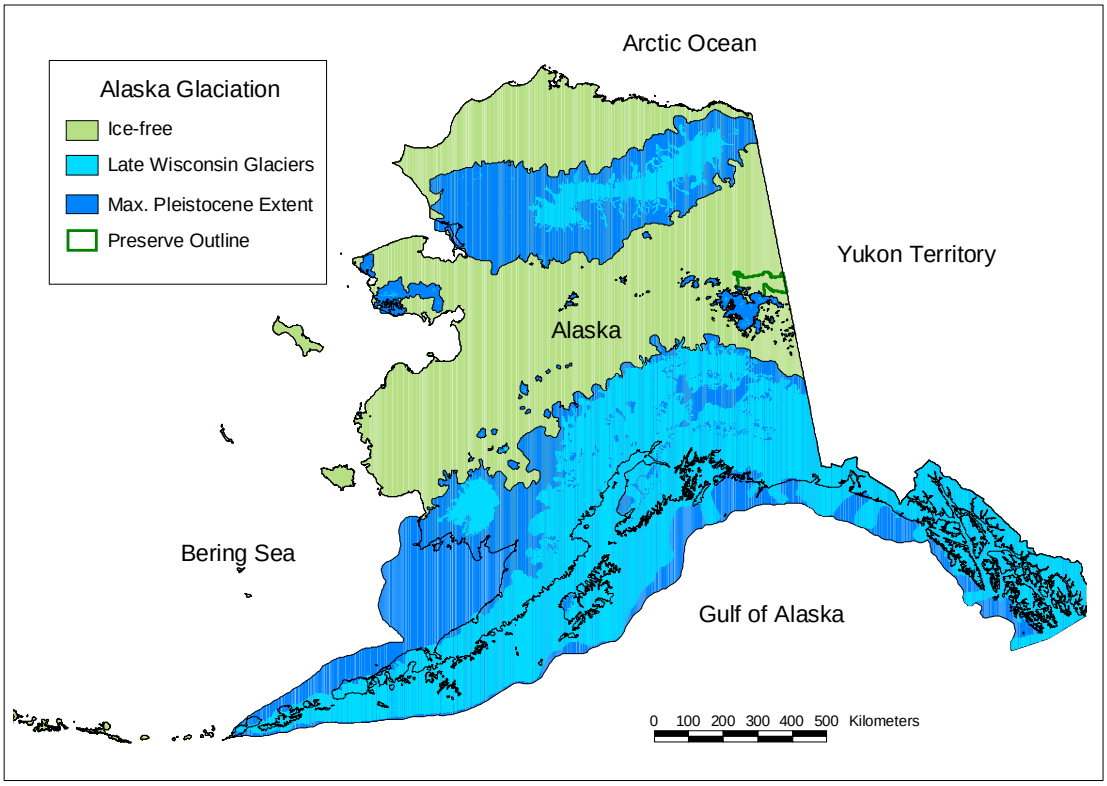

Figure 2.4. Generalized map of Alaska showing ice free corridor between maximum ice sheets during Pleistocene and late Wisconsin. (Mercator projection, NAD 1927)

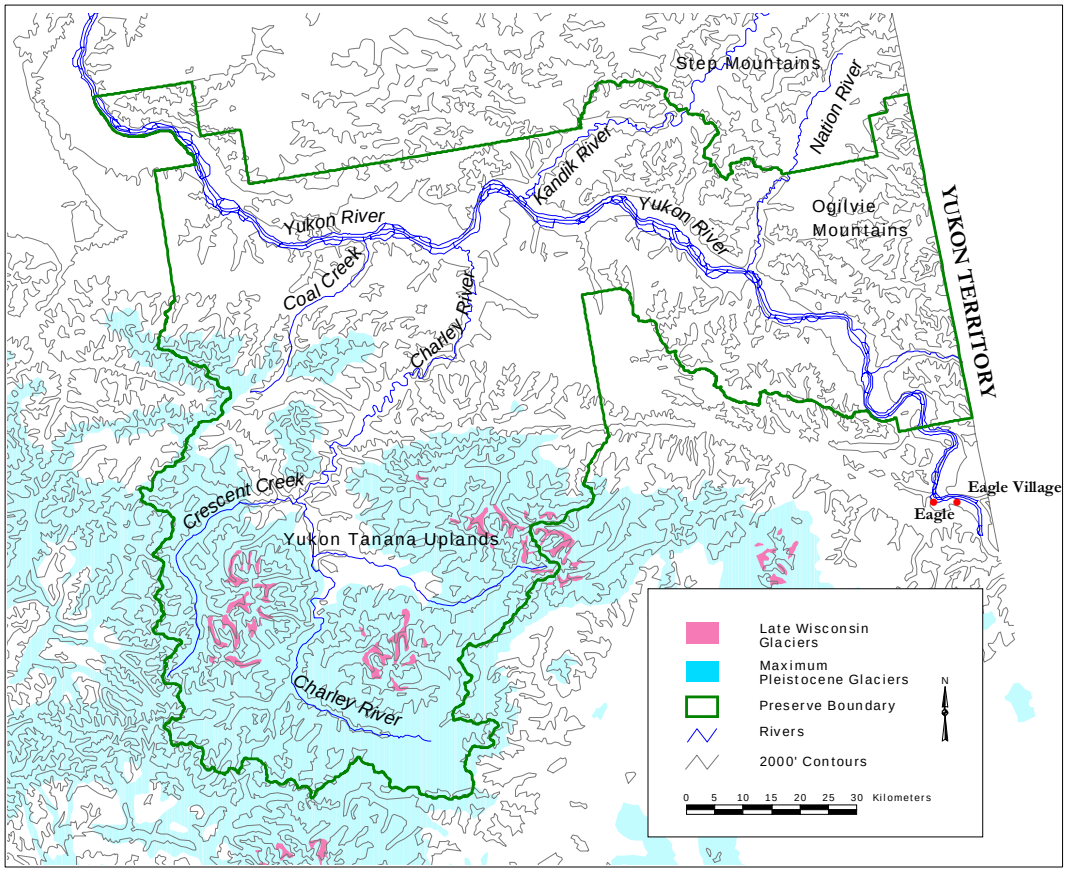

Figure 2.5. Maximum extent of the Quaternary Cordilleran ice sheet in Yukon-Charley Rivers National Preserve. (Mercator Projection, NAD 1927)

Plate 2.10. This large cirque lies in the headwaters of the Charley River where alpine glaciers persisted during the Pleistocene. Photograph by C. Roland.

Plate 2.11. Located in the headwaters of the Diamond Fork of the Seventymile River, this large U-shaped valley is characteristic of the glacial activity that sculpted this land during the glacial maximum. Photograph by D. Wilder.

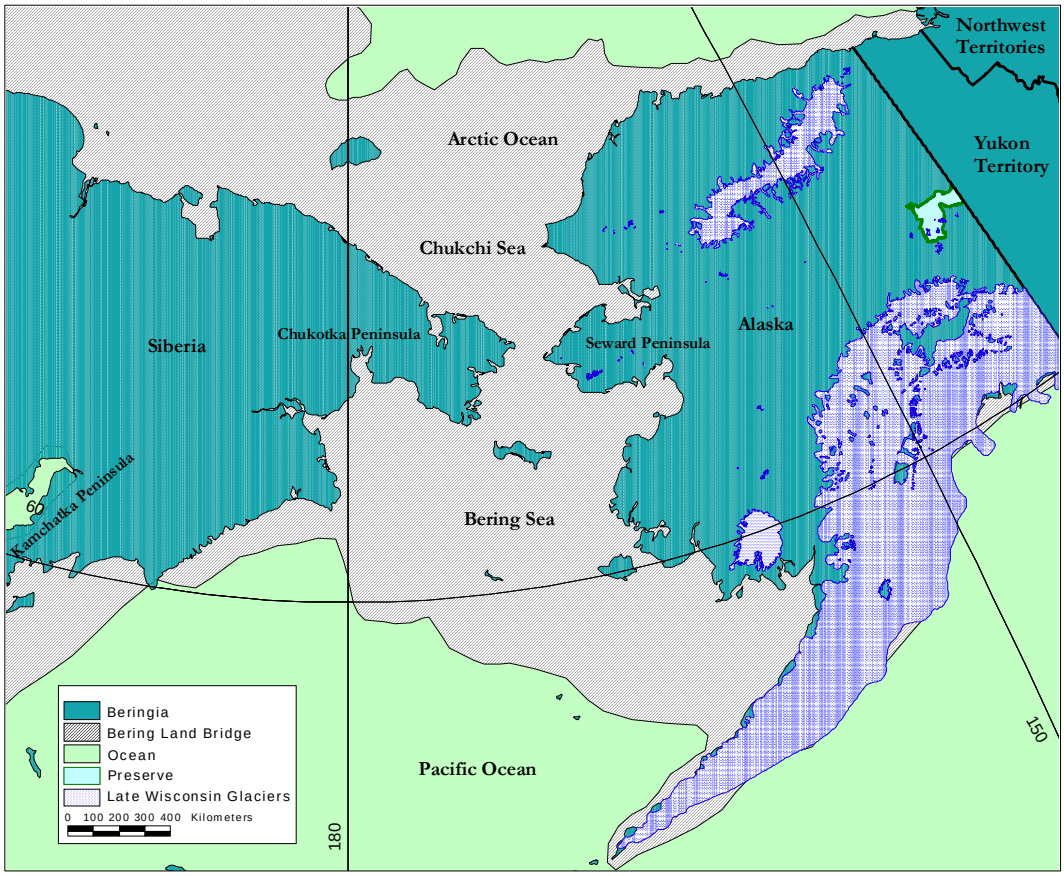

Figure 2.6. The Bering Land Bridge connected an ice-free landscape that stretched from the Mackenzie River in Canada to the Lena River in Siberia, now known as Beringia. (Mercator Projection, NAD 1927)

Ecological History

Fire

Fire is the dominant natural disturbance on the landscape in Yukon-Charley Rivers National Preserve (Plate 2.12); an estimated 70% of the Preserve is subject to periodic wildfire (Guldager 2001). An average of 8,000 hectares burns each year within the Preserve and nearly all fire ignition sources are lightning caused. Since 1955, over 360,000 hectares have burned within Yukon-Charley Rivers National Preserve (Table 2.1; Figure 2.7; Jennifer Allen 2004, personal comm.). Geographic and climatic factors within the Preserve enable wildland fires to ignite and burn. The Preserve lies within an interior basin, surrounded by mountains to the north and south. This basin experiences high lightning occurrence, low precipitation and high temperatures in the summer months. Forest fires are extremely common in all three physiographic regions in the Preserve.

Table 2.1 Statistics for major wildland fires recorded in Yukon-Charley Rivers National Preserve between 1955 and 2003 (Jennifer Allen 2004, personal comm.).

Fire Statistics	Hectares
Total hectares 1955-2003	365,014.5
Average number of hectares per year	7,449.3
Average fire size	2,703.6

Fire is of critical importance in the development and succession of the boreal forest within the Preserve. The most frequently burned habitats in the Preserve are the forested areas, virtually all of which have burned in the recent past. Less frequently burned sites include steep bluffs; even less frequently burned are the sparsely wooded stands in the upper Charley River drainage, where 300-400 year old black spruce have been found. These sites show no evidence of fire (Young 1976). Re-colonization of burned areas largely depends on the burn severity. Perennial plants such as grasses, sedges, and deciduous trees and shrubs re-sprout vigorously even after a moderately severe fire. Re-colonization rates of these species are often reduced following severe fires when underground storage parts are burned. Early successional species such as *Epilobium angustifolium* (fireweed), *Polygonum alaskanum* (Eskimo rhubarb), and other disturbance tolerant species also return rapidly following fire especially following severe fires where competition with perennial species is reduced. Colonization rates are fueled by the release of trapped nutrients which leads to higher rates of primary production and subsequently higher reproductive rates. Usually colonial plant species are well established within a year or two and natural successional processes proceed rapidly. Within a few years, willows appear on wetter sites, white birch invades more mesic areas, and drier sites support pole stands of aspen and birch. In time, white spruce is usually reestablished although white birch/aspen stands may persist (Young 1976). Many boreal forest plant species have evolutionary adaptations to deal with fire. Additionally, species dominance shifts throughout the different successional stages after fire. These

Plate 2.12. Fire plays a major role in the ecosystem dynamics of Yukon-Charley Rivers National Preserve. Photograph by C. Roland.

Plate 2.13. This large gravel deposition at the mouth of the Nation River is a prime example of the fluvial disturbances that impact vegetation in the Preserve. Photograph by P. Knuckles.

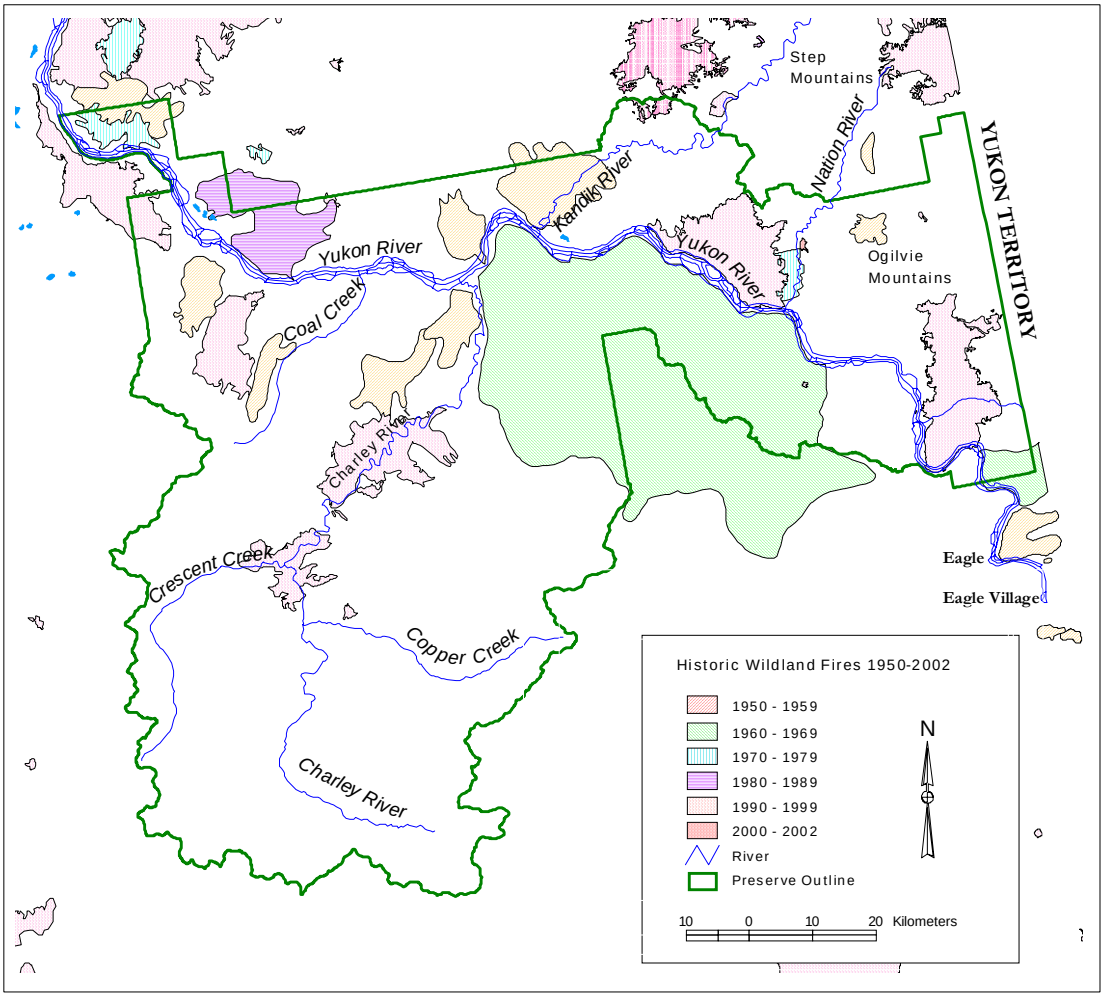

Figure 2.7. Generalized map showing major wildfires recorded in Yukon-Charley Rivers National Preserve between 1950 and 2002 (Jennifer Allen 2004). (Mercator Projection, NAD 1927)

adaptations combined with succession and the variable nature of fire distribution and severity all interact to create a mosaic of vegetation across the landscape.

Fire plays an important role in the mosaic of vegetation. It appears this may be particularly important in the survival of subarctic steppe populations on the river bluffs. On the site of a 1969 fire (Montauk Bluff), a 1956 USGS quad map showed the area was "forest". In 1990, after the fire, when the area was visited, it was covered by steppe vegetation. In the case of this nearly east-facing site, steppe taxa probably owe their presence on the bluff to the removal of the forest by fire. Since studies suggest that shade deters the survival of subarctic steppe taxa, fire apparently helps maintain these taxa by removing and suppressing forest and shrub overstory (Roland 1990).

Fire also plays a key role in regulation of the permafrost table throughout all ecosystems of interior Alaska. Without fire, an insulating layer of organic material accumulates, the permafrost table rises, and ecosystem productivity declines. Apparently the removal of shade and insulating moss by fire permits the ground surface to warm and subsurface ice to melt. This warming may persist for 10 to 15 years, permitting ice to melt down to a depth of one meter. In 25 to 50 years, the moss covering will be reestablished and the forest canopy will again provide shade, permitting the permafrost to begin to reestablish itself (Viereck 1989, Young 1976).

Fluvial Disturbance

The vegetation mosaic of Yukon-Charley can be attributed, in part, to the continued erosion, deposition, and flooding along the Yukon River and the lower channels of some of the major tributaries (Plate 2.13). Seasonal flooding creates a band of periodically inundated terrain along both shores of the river. During spring breakup, ice scours along the riverbanks. Where banks are moderately steep and exposed, only the most disturbance-tolerant species can survive. Similarly, early-successional wetland vegetation persists on newly formed river bars and shoreline deposits. As river bars stabilize, they are colonized by willows, eventually becoming nearly impenetrable thickets of *Salix pulchra*, *S. lanata* and *S. alaxensis*. Although these thickets may be stable for a considerable time, it appears that, if left undisturbed, they eventually are colonized by cottonwood (*Populus balsamifera*) and white spruce (*Picea glauca*). In some areas, particularly on islands, pure, even-aged cottonwood stands are formed (Young 1976).

Steep slopes of unconsolidated materials, combined with undercutting by the Yukon River, make rockslides a common occurrence. Fluvial processes also contribute to the survival of subarctic steppe communities. Many steppe taxa inhabit these rocky, disturbed sites due to their tolerance of moisture stress and affinity for high light (Wesser 1989). This high frequency of disturbance could help to perpetuate steppe vegetation by periodically removing competition (Roland 1990).

Climate

A strong continental climate prevails throughout the entire Preserve with short warm summers and long very cold winters. Mountain ranges to the north and south tend to block the moderating oceanic air masses, resulting in extremely low temperatures and frequent low-level inversions in the winter and very high temperatures and low precipitation in the summer. Mean monthly temperatures range from an average high of 14.2^{o}C in June to an average low of 24.2^{o}C in January (Figure 2.8). Average annual precipitation is very low within the Preserve, approximately 30 cm/year. The wettest month on average is July with 5.3 cm of precipitation (Plate 2.14) and the driest month is April with less than a centimeter (0.75 cm) of precipitation (Figure 2.9). The entire region is underlain by discontinuous permafrost which prevails in valley bottoms and on north facing slopes. Permafrost plays an important role in the ecology of the Preserve by trapping the little precipitation that falls in the Preserve and making it available for use by plants and animals (Davis 2001).

Vegetation

The Preserve lies within the northern boreal forest biome, or taiga. This biome is characterized by extensive subarctic forests dominated by conifers and several widespread species of hardwoods (Plate 2.15). Several forested ecotypes exist within the Preserve. Large open muskegs, dominated by *Picea mariana* (black spruce), occur throughout the Preserve and are concentrated on the large flat expanses near the Yukon River and its tributaries. Muskeg also occurs on poorly drained slopes underlain by permafrost where the dominant tree species, *Picea mariana* (black spruce), can be found growing at elevations as high as 900 meters (Young 1976). White spruce (*Picea glauca*) forests prevail largely on moderately drained soils in narrow bands adjacent to the rivers. Drier and warmer south-facing slopes and recently burned areas are occupied by *Populus tremuloides* woodland and open patches of steppe vegetation (Roland 1996). Dense populations of *Populus balsamifera* forests are typically found in well drained low elevation sites such as islands and terraces along the Yukon whereas *Betula papyrifera* forests dominate well drained sites at higher elevations. Riparian corridors support *Populus balsamifera* and dense *Alnus* thickets (Plate 2.16) although less disturbed sites may have *Picea glauca* forests (Roland 1996).

The dominant community above tree line is shrub tundra, a dense mat of low shrubs (less than 60 centimeters high), covering high slopes and valleys above 600 meters and intergrading with upland spruce/hardwood forest and making up the understory in many of the open, higher elevation forest stands (Plate 2.17). Above 900 meters, alpine tundra, a mat of vegetation rarely more than a few centimeters high (Plate 2.18), is dispersed among large patches of bare ground and rock. Poorly drained sites that are too wet for black spruce are dominated by tussock-forming sedges and grasses (Davies 1989). Probably because of a combination of microclimate and topography, some of these areas support plant associations more characteristic of the Brooks Range or the Arctic coast.

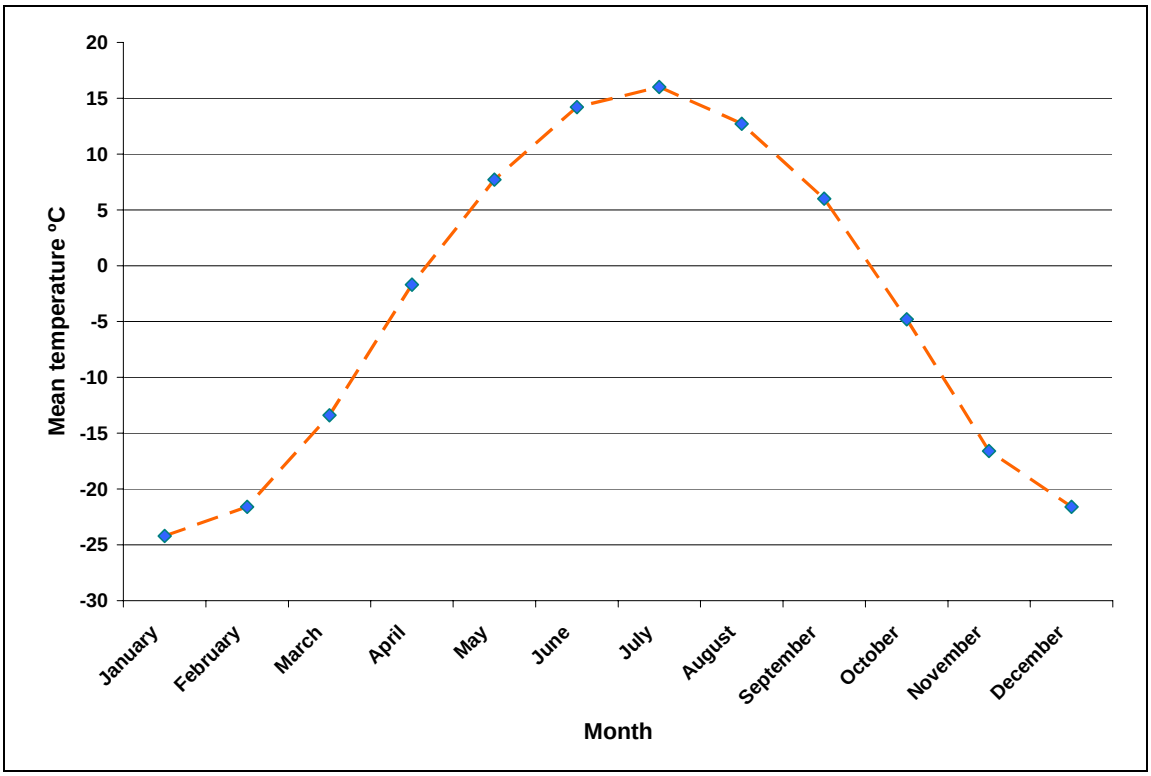

Figure 2.8. Thirty year normal for mean monthly temperatures recorded from 1971 to 2000 in the vicinity of Yukon-Charley Rivers National Preserve.

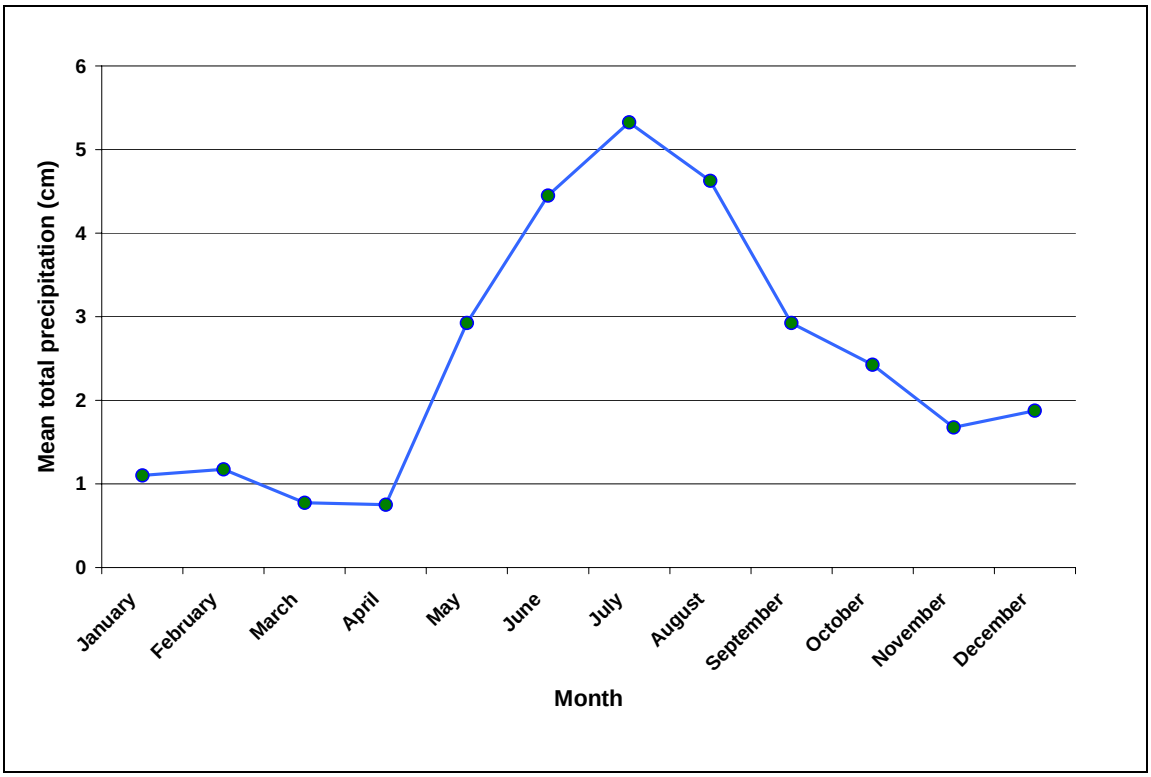

Figure 2.9. Thirty year normal for mean monthly precipitation recorded from 1971 to 2000 in the vicinity of Yukon-Charley Rivers National Preserve.

Plate 2.14. The majority of precipitation falls during summer, often in conjunction with thunderstorm clouds. Photograph by A. Larsen.

Plate 2.15. Large expanses of taiga were found along the Yukon and the lower reaches of the major rivers in the Preserve. Photograph by A. Larsen.

Plate 2.16. Mixed deciduous forests line the Yukon River where ice scours the banks each year. Photograph by A. Larsen.

Plate 2.17. Lush snowmelt bed near the interface with the subalpine zone of the Ogilvie Mountains. Photograph by C. Roland.

Chapter 3 History of Botanical Collecting in Yukon-Charley Rivers National Preserve

The rivers of interior Alaska have long been the most important means by which people have explored this remote territory (Plate 3.1). The Yukon River served, and continues to serve, as the primary route by which people visit Yukon-Charley Rivers National Preserve. This trend was true for scientific endeavors, including botanical collections, which occurred within the boundaries of Yukon-Charley. As a result, our floristic knowledge of the Preserve has largely been limited to a narrow region that adjoins the major river corridors.

Early botanical collections: 1883 – 1980

In 1940, Eric Hultén chronicled known botanical collections throughout Alaska. He noted several individuals that had made collections within the modern boundaries of the Preserve between 1883 and 1937. All of these collections were made along the Yukon River and its tributaries.

The collection history from 1940 to the time when the Preserve was established in 1980 is less well recorded. Yet, during this time period, some important botanical discoveries were made regarding the floristics of Yukon-Charley. In 1960, Hosford Shacklette reported the discovery of a site rich in endemic and rare species on the steep south-facing slopes of Eagle Bluff above the town of Eagle. Even though he worked outside Preserve boundary, he was the first to describe its distinctive flora and aroused interest among botanists in the area. In 1976, Steve Young began researching steep south-facing slopes along the Yukon River. His field work included efforts along the Charley River and on Kathul Mountain. Based on his observations he theorized that these communities resembled the arid, treeless habitat thought to be present during the late-glacial age. His work drew attention to the importance of these subarctic steppe communities. His observations matched a theory proposed by Russian botanist Boris Yurtsev studying similar steppe populations in Russian Beringia. In 1972, Yurtsev postulated that the steppe communities were remnant, relict communities of that ancient steppe (Murray In: Parker 1995, p. iv-v). The first intensive study of these bluff communities along the upper Yukon River was published by Alan Batten of the University of Alaska Herbarium in 1979 (Batten et al. 1979).

Recent collections: 1980 – 2002

During this time period numerous botanists and plant ecologists, including W. Scott Armbruster, Marilyn Barker, Alan Batten, Mary Beth Cook, Janice Daw, Mary E. Edwards, Randy Howenstein, Rob Lipkin, Dave Murray, Carolyn Parker, Carl Roland, Sara Wesser, and Steven Young, collected rare plant species associated with the steep south-facing bluffs lining the Yukon and Charley rivers (Armbruster and Edwards 1987, Cook et al. 1993, Edwards and Armbruster 1989, Knuckles and Wesser 1992, Parker and Batten 1995, Parker 1997, Roland 1990, Roland 1996). As their plant discoveries were reported, and their rarity and isolated distribution revealed, it was proposed that this

modern bluff vegetation showed the same floristic profile as the pollen spectra observed for late-glacial age vegetation. In 1981, University of Alaska Fairbanks (UAF) botanists brought a team of Russian scientists to visit the bluff system, permitting them to investigate their proposed Beringian connection and compare Alaskan steppe communities with proposed relict steppe communities in the Russian Far East. Their observations were published in 1983 and 1984 (Murray et al. 1983, Yurtsev 1984a and b). During this time, inventory work still concentrated on the accessible river corridors and significant bluff communities with some brief collecting around the cirque lakes.

In recent years, a number of Yukon-Charley research projects investigating wildlife populations and fire ecology have created significant botanical collections from a few selected areas, but overall, the flora of the rest of the Preserve has remained relatively unstudied.

Brief description of botanical collections reported for Yukon-Charley Rivers National Preserve

The first documented reference in Hultén's botanical history of Alaska (Hultén 1940) to scientific collecting of plant specimens in the region of what is now Yukon-Charley Rivers National Preserve is a note published in the Botanical Gazette dated 1884. This note refers to a small collection made by **Frederick Schwatka** in **1883** during a military reconnaissance of the Yukon River (Schwatka 1884). This collection was sent to Sereno Watson for determination. A full report of the expedition was published in a Congressional Report (Schwatka 1885). His journals were published in 1893 (Schwatka 1893).

Frederick Funston of the U.S. Department of Agriculture spent the summers of 1892-1894 collecting plants from coastal and interior Alaska. In **1893**, he followed the Yukon River system to his winter station at Rampart House on the Yukon Border, traveling through the present-day Preserve boundaries. From May 23 to August 25 he stayed in Forty Mile Creek vicinity, just south of the Preserve boundary, collecting plants. On July 30, he reported collecting at Coal Creek Hill. His collections are in the National Herbarium in Washington, D. C. and reports are available on his plant collecting expeditions around coastal Alaska (Hultén 1940).

From **1898-1900**, **Charles Christian Georgeson**, director of the Agricultural Experiment Station in Sitka, collected 200 specimens from Sitka, Kodiak, Rampart, Fort Yukon, and, in July of 1900, from Eagle. His collection is in the National Herbarium in Washington D. C.(Hultén 1940).

J.C. Cantwell, commander of the Revenue Steamer Nuniwak on the Yukon River from **1899-1901**, collected plants along the 1000 mile length of the river. Collections were deposited with the Academy of Science in San Francisco but were apparently destroyed in the great earthquake and fire. A short list of species determined by Alice Eastwood was published in 1901 (Cantwell 1901, p. 290).

Wilfred H. Osgood, Assistant Biologist, US Biological Survey, participated in a biological reconnaissance of the Yukon River. In **1899**, he collected along the length of the Yukon River then returned in **1903** to spend June through August collecting around Eagle and Circle. His collections were determined by Colville and a partial list published in the North American Fauna (Osgood 1901).

Arthur James Collier, US Geological Survey, collected plants along the Yukon River from the mouth to Dawson, passing through the Preserve boundaries. On July 14, **1902** he reported collecting on Woodchopper Creek. A report on the work accomplished in 1902 was published in the US Geological Bulletin (Collier 1903).

From June through August of **1903**, **Charles Arthur Hollick** of the New York Botanical Garden (NYBG) collected plant specimens along the Yukon River between Dawson and Anvik while doing paleontological work. These collections are stored with the NYBG (Hultén 1940).

Albert Spear Hitchcock, chief agrostologist for US Department of Agriculture, and Royal and Shaw Kellogg, US Forest Service, collected 800 numbers, chiefly grasses, in Alaska in **1909**. They spent one day collecting around Eagle and Circle City. Kellogg published their results in a report "The Forests of Alaska" (Kellogg 1910).

Donaldson Delorme Cairnes, geologist with the Canada Geological Survey, made a small collection along the Yukon River including specimens from Nation River. Lists of plants collected were published in **1911** and **1912** (Macoun 1911, 1912).

John Beaver Mertie, a geologist with USGS who worked in Alaska from 1911 to 1942, made a botanical collection in **1930** in the Tatonduk-Nation River district along the Alaska portion of the Yukon River. A list of the plants he collected, as determined by C.V. Morton, was published by the USGS (Mertie 1932).

Edith Scamman, a researcher from Maine associated with Harvard's Gray Herbarium, collected extensively around Alaska. After hearing her father's gold field stories she traveled to Alaska in 1920 then returned to make botanical collections during several summers between 1936 and 1954. In **1936,** she collected along the Yukon River, including a stop in Eagle, just outside the Preserve boundary. Her numerous specimens are in the Gray Herbarium (Scamman 1940).

Park records report the following botanical collections that have been made since 1940.

In **1956, George W**. **Argus,** leading authority on the genus Salix and author of The Genus Salix in Alaska and the Yukon (Argus 1973), collected along the Charley River as a part of his early research on the ecology of interior Alaska. Ten of his specimens are in YUCH herbarium.

In **1960, Hosford Shacklette,** a geologist, was the first to report the presence of the unique association of plants occurring along the Yukon River (Shacklette 1966). He

proposed that the high rate of endemism in the flora of Eagle Bluff, just outside the Preserve boundary, was a result of the phytotoxic elements contained in the greenstone bedrock there. His theory has since been disproved but his contribution to the knowledge of the area was considerable. He discovered four new species for Alaska (including *Cryptantha shackletteana)*, several of which were not identified for many years, as well as generating interest in the area within the botanical community. His specimens are in the herbaria of University of Michigan in Ann Arbor, U S National Museum, Washington D. C. and the Naturhistoriska Riksmusset in Stockholm, Sweden.

In **1964, Ken Alt**, a fisheries biologist with Alaska Department of Fish and Game, collected along the Yukon River near Circle and the Tatonduk and Nation Rivers. Forty-one of his specimens are in the YUCH herbarium.

In **1964, Les Viereck**, Alaskan botanical authority and author of numerous publications on Alaska's flora, collected along the Yukon River above Circle, Charley River, and Chester Bluffs as part of a study of floodplain forest succession on the Yukon and Tanana rivers (Viereck 1989). He collected from several plots in the floodplains of the Yukon and lower Charley rivers as well as from a small bluff along the Charley River. He was accompanied by Keith (his assistant) and Anore (Bucknell) Jones. Forty four of his specimens are in the YUCH herbarium. Another 75 specimens from these collections can be found in ALA.

In **1974** and **1975**, **Steve Young,** a researcher from the Center for Northern Studies in Wolcott, Vermont, lead a team of 15 researchers in a study of the ecology of the area proposed for designation as the Yukon-Charley Rivers National Preserve. Several botanists from this team collected in the area, including Steve Young, Charles H. Racine, Peter J. Marchand, and Bruce Tiffney. His collections and publications drew attention to rare plant species on south-facing bluffs along Yukon and Charley rivers and proposed that, collectively, they represent a unique plant community, the "arctic steppe" (Young 1976). He suggested that there was a floristic similarity between the modern bluff vegetation and the floristic profile of pollen spectra of late-glacial vegetation. Most of the collections are in the herbarium of the Center for Northern Studies plus a few in ALA. One specimen is in the YUCH herbarium (Young 1976).

In **1978, Alan Batten, David Murray** and **Janice Daw**, UAF Institute for Arctic Biology, conducted the first intensive study of bluff vegetation along the Yukon River. Their report made recommendations for future studies of this distinctive flora (Batten et al. 1979). Primary specimens are in ALA herbarium; 63 specimens from Calico Bluff, Montauk Bluff and Kathul Mountain are in YUCH herbarium.

In **1979, Katrina Kassler**, a student from Middlebury College in Vermont, collected plants in the Preserve as part of her field studies for her thesis "Relicts of the Late Pleistocene Arctic-Steppe Investigations of Certain South-facing Slopes of Interior Alaska". All of her collections are in the herbarium of Middlebury College (Kassler 1979).

In **1981**, UAF professor and herbarium curator **David Murray** took a group of Russian scientists (botanists and a soil scientist) on a brief trip to Eagle and then downstream on the Yukon River as far as Calico Bluff. Their observations were published by Murray (Murray et al. 1983) and Boris Yurtsev (1984a, 1984b). Nearly all of their specimens can be found in the ALA herbarium but they did place two specimens from Calico Bluff in the YUCH collection.

In **1982** and **1983, Randal Howenstein** recorded plant species' distributions at various sites along Porcupine and Yukon rivers as part of his graduate research interpreting the biogeography of the steppe islands. His observations can be found in his unpublished thesis (Howenstein 1994) and, in part, in Murray et al. (1983). His specimens are at ALA.

In **1982** and **1984, Marlene Moldenhauer,** NPS wildlife biologist, collected plants while doing sheep surveys in the Preserve. She has 459 specimens from Montauk Bluff, Ft. Egbert, American Summit, Eagle, Dewey Creek, Montauk Bluff, Eagle, Calico, Slaven Cabin, and Jones Ridge (Canada) in the YUCH herbarium.

In **1983, J. Dixon** and **Tim Beaucage** established fire effect (Fire Pro) plots at Trout Creek Fire, Cathedral Creek, Hard Luck Creek, Castle Mountain, Funnel Creek, Diamond Pingo, Witch Creek, Essie Creek, Mt Sorenson, Kathul Mtn, and along the Yukon River. They have 74 specimens in the YUCH herbarium. In **1986**, G. Downing and D. Hoffman surveyed these sites and added 114 specimens to the YUCH herbarium.

Mike Britten, and **Carol McIntyre,** NPS biological technicians, conducted avifauna surveys in **1985** and **1986.** There are 130 of their specimens from Charley River sites in the YUCH herbarium.

1987 Sara (Doman) Wesser, NPS and UAF, and **Donna DeVoe,** UAF, sampled major steppe communities on seven sites from Calico Bluff downstream to Nation Bluff for comparison with Wesser's thesis research on Eagle Bluff. Their surveys suggested that species composition on different sites may be a response to historical events (isolation, disturbance, fire, dispersal, or past climate) rather than some measurable environmental parameter (slope, aspect, soil type). They also found that elevation was important. YUCH has 123 of their specimens from Eagle Bluff, Calico Bluff, and Montauk Bluff (Doman 1987).

In **1988, Linda Mutch** and **Bruce Haller,** NPS fire technicians, established fire effect monitoring plots. They placed 387 specimens in the YUCH herbarium from Cirque Lakes, Fisher Creek, Mt. Sorenson, Arctic Dome, Eureka Cr, Woodchopper Cr, Charley R, Copper Cr, and Slaven Dome.

In **1988** and **1989, Sara (Doman) Wesser**, NPS and UAF, examined environmental controls over species distribution across a forest-steppe transition on Eagle Bluff. She placed 22 specimens from Eagle Bluff in the YUCH herbarium (Wesser 1991).

In **1989, Mary Edwards** and **Scott Armbruster** studied the interaction of environmental variables along the tundra-steppe transition on Kathul Mountain. They showed that the interaction of slope, aspect and elevation are important determinants of species composition within steppe community. They suggested that these environmental factors may determine the availability of moisture and temperature. Their specimens are in ALA (Edwards 1989).

From **1989** to **1995 Penny Knuckles**, NPS resource management specialist for Yukon-Charley Rivers National Preserve, participated in numerous botanical studies in the Preserve**.** The YUCH herbarium has more than 250 of her specimens from throughout Preserve (Cook et al. 1993, Knuckles 1992).

From approximately **1989** through **1990**, Kerry Heise served as NPS botanist for the Fire Pro project. Fourteen of his specimens are in the YUCH herbarium.

In **1990** and **1991, Carl Roland,** NPS biological technician**,** sampled vegetative cover and topographic parameters at 15 different sites on 8 bluff localities along the Yukon River. His primary collections are in ALA. He placed 68 specimens from Cirque Lake, Eureka Creek, and Charley River in the YUCH herbarium (Roland 1990, 1991). Roland made additional collections in the Preserve during the summers of 1991-1993 as part of his master's thesis (Roland 1996). Specimens are in ALA.

In **1991, Jennifer Brown** and **Todd Bohle,** NPS biological technicians, prepared a small plant collection while ground-truthing the land cover map of Yukon-Charley published by the NPS Alaska Regional Office in 1997. There are 17 of their specimens from Yukon, Cathedral, and Nation rivers and Bluff in YUCH herbarium.

In **1993, Mary Beth Cook,** Wrangell-St. Elias botanist, with **Rob Lipkin**, AKNHP research botanist, and **Penny Knuckles**, Yukon-Charley natural resource specialist, prepared an extensive collection as part of a brief but intensive floristic survey of the as yet unsurveyed flora of the western region of the Ogilvie Mountains, seeking to determine the uniqueness and diversity of this region (Cook et al 1993). There are 247 of their specimens from Nation River, Cathedral Creek, and Hillard Mountain in the YUCH herbarium. Rob Lipkin's collection is in the ALA herbarium.

In **1995, Carolyn Parker** and **Al Batten** of the UAF Museum conducted an extensive inventory of status and trends of Category 2 plants in the Preserve. Intensive inventories were carried out on sites on lower Tatonduk and Kandik rivers, Montauk Bluff on the Yukon River, Hillard Peak, and Eagle Bluff. Most of their specimens are in ALA; there are 48 of their specimens in the YUCH herbarium (Parker 1995).

In **1996, Carolyn Parker,** UAF Museum**,** conducted rare plant and floristic surveys of selected sites on Mt Casca, VABM Pack, '19 mile' and '23 mile' bluffs, Takoma Bluff, and Webber and Woodchopper Creek bluffs. Her primary collections are held at ALA; duplicates are in YUCH herbarium (Parker 1997).

In **2002, Chris McKee,** UAF and USGS, conducted an inventory of exotics in the Preserve as part of his master's research. His collections are in ALA (Chris McKee 2004, personal comm.)

Prior to this study much research was conducted on the vascular plant flora both within the Preserve and in adjoining lands. This work has been pivotal in understanding plant communities in the Preserve. Well over 4500 vouchered specimens were collected in the vicinity of Yukon-Charley Rivers National Preserve prior to this survey. The majority of specimens, 3208 vouchers, are housed at the University of Alaska Fairbanks Herbarium. The Preserve houses some 1161 specimens and the remaining specimens are scattered around the world in different herbariums. These contributions provided an excellent foundation upon which this work was based.

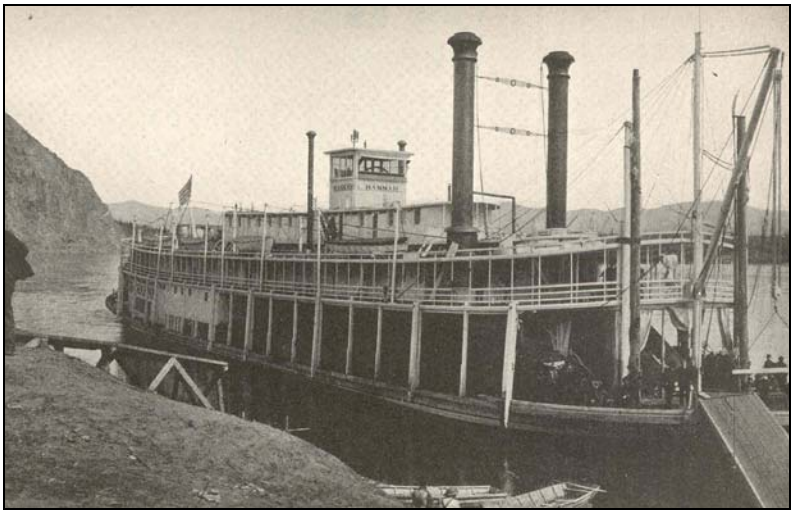

Plate 3.1. The Yukon River remains the primary route used by visitors to explore the Preserve as well as the principal avenue for scientific exploration in the region. (1904 photograph of U. S. Revenue Steamer Ninivak by J.C. Cantwell.)

Chapter 4 Methods

This inventory was a survey of the vascular plant flora of Yukon-Charley Rivers National Preserve. The fundamental objective of this study was to obtain a set of well-documented, geo-referenced voucher specimens for the vascular plant taxa found within the 1.01 million ha Preserve. Limitations on time and funding available for the survey made it essential for the survey to direct all efforts toward maximizing the efficiency of finding and documenting as many new species as possible. To accomplish this it was imperative that we carefully review past data collection both in and around the Preserve and clearly identify data gaps within the Preserve.

This process was initiated in 2000, when the NPS Alaska Regional Office contracted with the Alaska Natural Heritage Program to compile the existing vascular plant species data for each of the National Park units including Yukon-Charley. As a first step in this process, AKNHP generated a list of all vascular plant species known from the Preserve and supported by a voucher specimen. From this list, and lists of species reported within a 50 km buffer surrounding the Preserve, AKNHP developed a list of taxa that could reasonably be expected to occur in the Preserve but had not yet been found. The 50 km buffer used was a somewhat conservative means by which to estimate the species expected to be found within the Preserve; many species are found to be disjunct over hundreds of kilometers and certain groups of plants (e.g. aquatics, graminoids, and crucifers) are notoriously under-collected and prone to turn up in new locations separated by large distances from their main range. Short of including the entire flora of Alaska (and adjacent regions) in the *Probably Present* list, there was no simple way to geographically determine a *Probably Present* species list. The 50 km buffer was chosen as one that would reasonably include species in similar climatic and biological settings. We recognize that the use of a spatial buffer based solely on distance is inherently arbitrary and likely to lead to errors of both inclusion and exclusion. AKNHP attempted to correct many of these errors (such as excluding plants particular to substrates not found in a Park unit). This final list of *Probably Present* species was used to efficiently target field work and was also designed to serve as the basis for determining the completeness of the inventory after we completed the data analysis.

To successfully document and track each voucher specimen collected during the plant inventory it was essential to have a database that was designed to deal with complex data involving taxonomic information, habitat data and detailed site descriptions. We used a database developed during a vascular plant inventory in Wrangell-St. Elias National Park and Preserve from 1994 -1997 to store, summarize and track data from this inventory (Cook and Roland 2002). This database represented an extensive body of work that provided us with a great deal of information regarding the biogeography, taxonomy, and floristics of each plant species. The database proved invaluable throughout the entire inventory process and we were fortunate to have this product available for our use.

This inventory was designed around field collections of plant specimens in a set of 135 study sites chosen to represent a full range of ecological conditions but targeting five under-collected areas of the Preserve. These target areas were: river islands and terraces, aquatic ecosystems, alpine sites in the northern Ogilvie Mountains, alpine areas in the Yukon-Tanana Uplands, and subalpine areas in the Upper Charley River Mountain Tundra and Three Fingers Subalpine Basin (Figure 4.1).

Over the summer months of 2002, a team of botanists collected plant specimens and supporting data in each of these 135 sites. Specimens were identified and processed by the principal botanists (Mary Beth Cook, Amy Larsen and Carl Roland). Problematic specimens were determined and/or verified by University of Alaska Fairbanks Herbarium staff Carolyn Parker and Alan Batten. As needed, selected specimens were sent to Dave Murray, UAF emeritus professor, for final determination. Final data were compiled, analyzed and interpreted by the principal botanists. This report describes the collections made and their implications for the understanding of the vascular flora of Yukon-Charley Rivers National Preserve.

Development of a vouchered vascular flora and expected species list for Yukon-Charley Rivers National Preserve

After the initial study plan was completed, NPS entered an agreement with the Alaska Natural Heritage Program (AKNHP). The goal of this work was to compile and verify historical and predicted species data. To accomplish this task AKNHP had four major objectives:

1. Document all vascular plant species that were known to be within the Preserve
2. Produce a list of vascular plant species expected to be within the Preserve
3. Compile supportive evidence on the status of each species and catalog this information in the bibliographic database NRBib
4. Use this information to populate the NPSpecies database.

AKNHP undertook seven tasks to fulfill the four project objectives listed above (Lenz et al. 2001). These seven tasks included:

1. Establishment of a spatial buffer to aid in developing expected species lists for the Preserve.
2. Compilation of references on vascular plants in Yukon-Charley for the NRBib database.
3. Compilation of vouchered data on vascular plants in Yukon-Charley.
4. Compilation of databases containing species information for entry into the database catalog.
5. Compilation of species lists for Yukon-Charley for entry into the NPSpecies database.
6. Peer review of the species lists.
7. Population of the NRBib and NPSpecies databases.

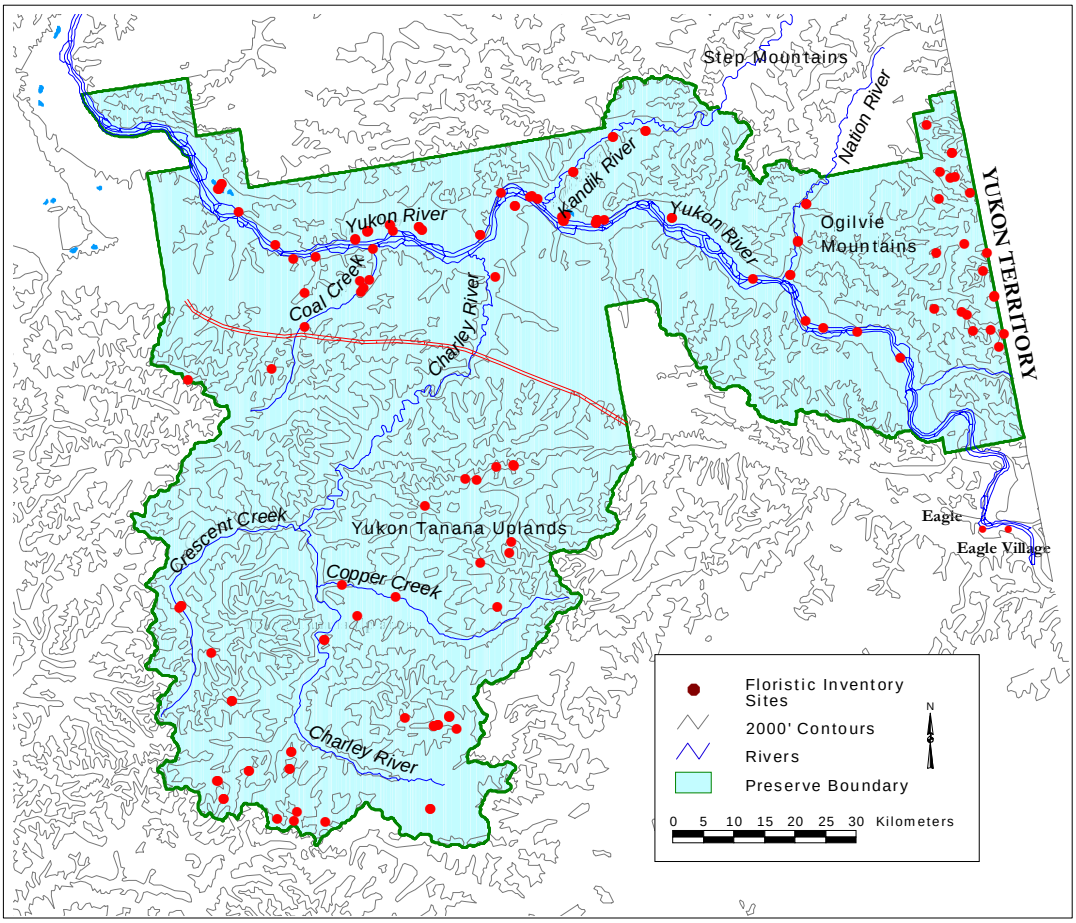

Figure 4.1 We surveyed 135 sites in Yukon-Charley Rivers National Preserve during the 2002 floristic inventory. (Mercator Projection, NAD 27)

The first phase of field planning for the inventory began in April 2000, when NPS contracted the Alaska Natural Heritage Program (AKNHP) to assemble and verify data from the principal herbaria containing specimens collected from Yukon-Charley Rivers National Preserve. This data was used to create a verified list of taxa already known to occur in the Preserve. AKNHP compiled this information and produced a specimen-based spread sheet documenting a proposed plant list for the Preserve. Nomenclature was standardized to USDA's PLANTS database (Kartesz et al. 1999). This list combined with floristic information from surrounding areas was used to generate a second list documenting the "expected species" ─ a list of species that are probably found within the boundaries of the Preserve.

To prepare a list of known species, AKNHP determined all species for which verified specimens had been collected within the Preserve boundary. In addition, if a voucher specimen for a species had been collected within 50 km of the Preserve boundary and was not known from with the Preserve, the taxon was designated as "expected" to occur in the Preserve. The Heritage Program list included 447 taxa (including infraspecific taxa such as subspecies and varieties) that have been documented within Yukon-Charley and another 271 taxa collected in a 50 km radius of the boundary and thus expected to occur in the Preserve. Species on the expected list represented the entire spectrum of habitats extant within the Preserve including lowland wetlands, subalpine meadows, aquatics, forested areas and alpine tundra species.

These lists provided valuable guidance in selection of plant specimens for inventory botanists to collect and areas to survey. However, since plant surveys within the Preserve have been limited in scope and scale, botanists also collected specimens from many "known" taxa in an effort to expand the scope of knowledge of the Preserve's flora.

Database system for tracking and analyzing floristic data in Yukon-Charley Rivers National Preserve

Specimen-based database files were created for all plant collections made during the inventory. These files were integrated into a National Park Service floristic database system that was developed for a vascular plant inventory of Wrangell-St. Elias National Park and Preserve (Cook and Roland 2003). A few modifications were made in the database to accommodate additional information collected during the Yukon-Charley inventory. This system is composed of three interrelated databases:

1. Taxon database – each record of this database represents an individual plant taxon with fields that contain information on the conservation status and taxonomic, anatomical, and biogeographic attributes of each taxon.

2. Site database – each record of this database represents a locality where plant occurrence data have been collected. Fields in this database describe the locality, including coordinate data and related precision information, elevation and other physical attributes; the amount and type of work done at the site; and, ecoregion attributes; significant floristic information are also recorded there.

3. Specimen database – each record of this database represents an individual plant specimen that was collected at a particular site. (Thus this database relates fields of the taxon database with the site database, using a unique collection number). This database contains information about the specific habitat and location of the plant population from which the collection was made. In addition, this database contains a set of fields for curation information for each specimen (such as collector name, collection number, and accession and catalog numbers). This database also reflects a specimen's determination history (who initially identified it and any changes to its identification over the years) (Roland 2004).

Focal areas for 2002 plant inventory field work in Yukon-Charley Rivers National Preserve

We surveyed a set of 135 study sites that represented a full range of ecoregion subsections, plant communities, cover types, and geographic areas found in Yukon-Charley Rivers National Preserve. Our survey efforts were differentially allocated among these sites because pre-existing floristic information was unevenly distributed among the different habitat types; as a result surveying effort dedicated to the various habitats of the Preserve varied considerably. For example, there had been a considerable amount of inventory effort directed at treeless xeric plant communities at low elevation on major river bluff features, but very little effort focused on open wetland sites adjacent to these bluffs. As a result, this inventory expended a minimum of effort on bluff sites but considerable effort on lowland wetland communities along the Yukon River corridor. In order to meet the goal of documenting 90% of the expected species, we focused on communities, regions and habitats that were under-represented in previous plant collecting efforts within the Preserve.

We identified a set of study regions that were targeted for plant inventory during this survey. These study areas fell into five general groups (not in priority order):

1. Wetland and aquatic habitats in the Yukon River Valley

2. Gravel bars and river terraces in the Yukon River Valley

3. Alpine sites on calcareous bedrock in the Ogilvie Mountains; alpine seeps throughout the Preserve

4. Alpine sites in the Yukon-Tanana Uplands (generally on crystalline bedrock)

5. Subalpine areas in the upper Charley River Mountain Tundra and Three Fingers Subalpine Basin ecological units

Within each of these study regions, we chose specific survey sites to maximize the number of community types and landscape features reachable in the allotted survey time. These diverse sites were selected by careful study of cartographic materials such as color infrared photos, landcover and geology maps, and related materials, the final selection of specific sites for this type of inventory work required aerial reconnaissance of potential sites to verify the environmental conditions at the site and to locate suitable areas for survey routes and base camps. Careful site selection increased the success of the floristic survey work by allowing us to visit a diverse array of sites that maximized the number of communities and ecotones for any given survey route.

We accessed the sites in groups 1 and 2 primarily via river boat travel on the Yukon River. We camped adjacent to wetland areas and hiked in to access survey sites. In addition, we performed five days of helicopter-assisted inventory work in wetland and aquatic habitats to access very difficult to reach sites along the Yukon, Nation and Kandik river valleys. Helicopters were used to access sites in the alpine and subalpine groups. Spur camps were established within the area to allow for extensive surveys within a single area that allowed access to diverse habitats. When possible, we made short day trips using the helicopter to nearby habitats to increase our exposure within each group.

Field methods and collections

The data acquired for the vascular plant inventory project consisted of a set of well-documented, geo-referenced and correctly identified voucher specimens for plant taxa. As a result, the majority of time in the field was dedicated towards making careful specimen collections of a broad spectrum of species. A species list was recorded for each site and collections of expected (and unexpected) new species and other targeted taxa were made. An array of ancillary data and materials were collected at each site to support this collection effort, including site photographs, selected species photographs, notes concerning vegetation types surveyed, detailed collection notes for each specimen, and notes concerning the abundance and distribution of plant taxa of particular interest. Handheld GPS units were used for acquiring collection and survey locations. Photographs were taken as 35mm slides which were then scanned for digital interpretation.

The survey method was “an informed meander” in which trained botanists made as complete as possible a search of the targeted survey areas with the goal of intersecting the maximum number of different plant communities and plant species per unit inventory time. Survey routes were chosen based upon the potential for encountering the maximum number of novel species.

Specimens were pressed in the field and allowed to dry. They were removed from presses upon drying and transferred to ALA, where they passed through a -50° C fumigation freezer to kill any potential pests. Determination work occurred in the University of Alaska Museum Herbarium, where botanists had access to a large collection of carefully determined specimens for comparative purposes (Roland 2004).

Field personnel

The following people were instrumental in the success of this project by performing substantial work in the field and making numerous important collections:

Alan Batten, Collections Manager for ALA, participated in field work, reviewed specimens, provided electronic data, and helped with curation of specimens.
Bruce Bennett, Botanist, NatureServe Yukon, Yukon Department of Environment, Canada, participated in field work.
Mary Beth Cook, Principal Investigator, Botanist, Wrangell-St. Elias National Park and Preserve, participated in field work.
Amy Larsen, Aquatic Ecologist, Yukon-Charley Rivers National Preserve, coordinated the project.
Carolyn Parker, Research Assistant for ALA, performed determinations and facilitated expert reviews.
Delia Person, USFWS, Botanist, Yukon Flats National Wildlife Refuge, participated in field work.
Carl Roland, Principal Investigator, Plant Ecologist, Denali National Park and Preserve, participated in field work.

In addition the following individuals provided valuable assistance on one or more individual plant collecting trips:

Jedediah Brodie, Biological Technician, Denali National Park and Preserve, participated in field work.
Melanie Cook, Biological Technician, Yukon-Charley/Gates of the Arctic National Park and Preserve, participated in field work.
Eric Groth, Biological Technician, Denali National Park and Preserve, participated in field work.
Doug Wilder, Database Manager, National Park Service Central Alaska Network, participated in field work.

Herbarium methods and review of specimens

Specimens were initially identified by principal NPS project botanists (Amy Larsen, Mary Beth Cook, and Carl Roland). Specimens were further reviewed by staff at ALA including Carolyn Parker, Alan Batten, and David Murray.

Data storage and management: curation of specimens – storage, mounting and housing

Collection and site data for each specimen collected were entered into the database. Accession and catalog numbers were assigned to each specimen and labels were printed on archival paper. Specimens were then mounted onto archival herbarium paper by staff at ALA. Specimens are housed both at the Preserve herbarium in Yukon-Charley Rivers National Preserve (YUCH), and at ALA in Fairbanks, Alaska (Roland 2004).

Determination of range extensions for plant taxa

We compared plant collections made during this inventory to the published plant distribution literature in order to document any range extensions for plant taxa. Range extension distances were measured using digitized locality information (with Arcview GIS software). The primary references that we used were: Hultén's *Flora of Alaska and Neighboring Territories* (Hultén 1968), William Cody's *Flora of Yukon Territory* (Cody 1996), *Vascular Plants of the Continental Northwest Territories* (Porsild and Cody 1980), and Cook and Roland 2002 (*Notable Vascular Plants from Alaska in Wrangell-St. Elias National Park and Preserve With Comments on the Floristics*.)

We defined two categories of range extensions for vascular plant taxa:

1. Major range extension – a new locality was 200 km or more from known site,
2. Range extension – a new locality was more than 70 km, but less than 200 km, from existing published localities.