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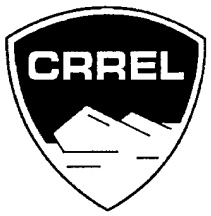

A Floristic Inventory and Spatial Database for Fort Wainwright, Interior Alaska

Charles Racine, Robert Lichvar, Barbara Murray,
Gerald Tande, Robert Lipkin, and Michael Duffy

October 1997

Abstract: An inventory of the vascular and ground-inhabiting cryptogam flora of Fort Wainwright, in interior Alaska, was conducted during the summer of 1995 to support land management needs related to the impact of training. Primary plant collecting, identification and verification were conducted by the Alaska Natural Heritage Program and the University of Alaska Museum. The work was supervised and the data compiled into a geographic information system by the USA Cold Regions Research and Engineering Laboratory and the USA Waterways Experiment Station.

Fort Wainwright covers 370,450 hectares (915,000 acres); it was divided into five areas: 1) the valleys of a cantonment area of base facilities, 2) the slopes and alpine areas of the Yukon–Tanana Uplands, 3) Tanana Flats and associated wetlands, 4) the upland buttes and Blair Lakes area in Tanana Flats, and 5) the floodplains of the Tanana and Chena Rivers. Over 100 sites were visited, with habitats ranging from very dry south-facing slopes to forest, floodplains, wetlands, and alpine tundra.

Vascular collections represented 491 species (including subspecies and varieties), included about 26% of Alaska's vascular flora, and are considered to be relatively complete. The cryptogam collections included 219 species, representing 92 mosses, 117 lichens, and 10 liverworts. The flora is characteristic of the circumpolar boreal forest and wetlands of both North America and Eurasia, but it also contains alpine and dry-grassland and steppe species.

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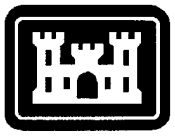

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A Floristic Inventory and Spatial Database for Fort Wainwright, Interior Alaska

Charles Racine, Robert Lichvar, Barbara Murray, Gerald Tande,
Robert Lipkin, and Michael Duffy

October 1997

Prepared for
U.S. Army Alaska

PREFACE

This report was prepared by Charles Racine, Ecologist, Geological Sciences Division, Research and Engineering Directorate, of the U.S. Army Cold Regions Research and Engineering Laboratory (CRREL); Robert Lichvar, Botanist, Ecological Resources Division, U.S. Army Waterways Experiment Station (WES); Barbara Murray, Botanist, University of Alaska Fairbanks (cryptogams); and Gerald F. Tande, Robert Lipkin and Michael Duffy, Botanists, Alaska Natural Heritage Program (AKNHP) (vascular plants).

This report is a summary of research findings and conclusions based on a CRREL–WES-sponsored inventory of both the vascular plants and cryptogams (mosses, lichens, and liverworts) growing on Fort Wainwright, Alaska. The report was synthesized and greatly expanded to include the GIS (geographic information system) database from reports submitted by the two major contractors. Peggy Robinson (CRREL) digitized and produced the maps using ARCVIEW.

Funding for this work was provided by the U.S. Army Integrated Training Area Management (ITAM) program through U.S. Army Alaska, Fort Richardson, Department of Public Works, Natural Resource Division, where William Gossweiler and Rhonda Beyke supported this work. At Fort Wainwright, Pamela Bruce and Walter Van den Heuvel helped with logistics and laboratory facilities for drying plants.

Botanists involved with verification and processing of specimens at the University of Alaska Museum include A.R. Batten, C. Parker, and Dr. D. Murray. They also made available their various unpublished field notes from investigations in the Fairbanks area. Dr. L.A. Viereck and J. Foote from the Institute of Northern Forestry gave freely of their time and provided species lists from their ongoing, long-term studies of boreal forest ecology in interior Alaska.

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INTRODUCTION

The purpose of this study is to provide an inventory and analysis of the existing flora of Fort Wainwright (FWA), a 370,450-hectare (915,000-acre) army base in interior Alaska near Fairbanks (Fig. 1). The floristic inventory is in support of the U.S. Army's Integrated Training Area Management (ITAM) program and provides a record of the plant genetic biodiversity on FWA. In addition, the record also helps support data needs in response to the Endangered Species Act (ESA), the National Environmental Policy Act (NEPA), and AR 420-74 for Natural Resources–Land, Forest and Wildlife Management. The inventory includes both vascular plants and ground-inhabiting cryptogams (lichens, mosses, and liverworts). The latter group is an important component of the Alaskan flora and vegetation. This inventory at FWA during 1995 follows a similar floristic inventory completed for Fort Richardson during 1994.

Additional objectives include:

1. Compile a preliminary list of potential species that might occur on FWA from herbarium and literature sources.
2. Subdivide FWA into floristic inventory areas to provide for representative collections from all parts of the facility.
3. Collect triplicate sets of all voucher vascular plant specimens and a duplicate set of cryptogams. This includes as comprehensive a collection of vascular plants as possible but only common ground-cover cryptogams.
4. Identify the specimens collected in the field to the appropriate subspecific level and conduct final verification of specimens by specialists at the Univeristy of Alaska Museum.
5. Characterize briefly the landscape and floristic setting of FWA.
6. Provide species lists for FWA to include relationships to floristic regions and habitats.
7. Compile a list of references useful for those without technical training for identification of cryptogams, with emphasis on illustrated works.

LITERATURE REVIEW

No comprehensive flora has been produced for the Fort Wainwright area of Alaska, even though the Fairbanks area is the center of activity for most of interior Alaska's population and is also a center for many of the State's natural resource agencies and the research facilities at the University of Alaska.

The nearest detailed vascular floristic surveys have been completed for the White Mountains, 105 km (65 mi) north of the base (Juday 1988, 1989); the Ray Mountains, 200 km (130 mi) northwest of Fairbanks (Kassler 1980); and various bluffs along the Yukon and Charley Rivers, 200 km (130 mi) northeast of the base (Alaska Planning Group 1974a, b, d, Batten et al. 1979, Kassler 1979, Howenstein et al. 1985, Young 1976a, b). Various surveys of localized areas of interest have been conducted over the years by herbarium researchers of the University of Alaska Museum (e.g., Murray 1994), and several species lists have been compiled by the Institute of Northern Forestry for the Bonanza Creek Experimental Forest over the course of ongoing, long-term, ecological research on the boreal forest (Foote 1992, 1995, Viereck et al. 1993). Other generally less complete lists have been made for area-specific vegetation studies of the Fairbanks area (see Methods).

STUDY AREA

Location

Fort Wainwright Military Installation (FWA) is located south and east of Fairbanks in interior Alaska (Fig. 1) between 64° 15′ and 65° 00′ north latitude and 148° 40′ and 146° 30′ west longitude. Study area boundaries for this investigation were defined by the Base boundaries found on the four 1:50,000-scale Defense Mapping Agency "Fort Wainwright Military Installation Maps, North (Cantonment and northern part of Tanana Flats), South (Tanana Flats including Blair Lakes area), East (Yukon Maneuver Area) and West (Tanana

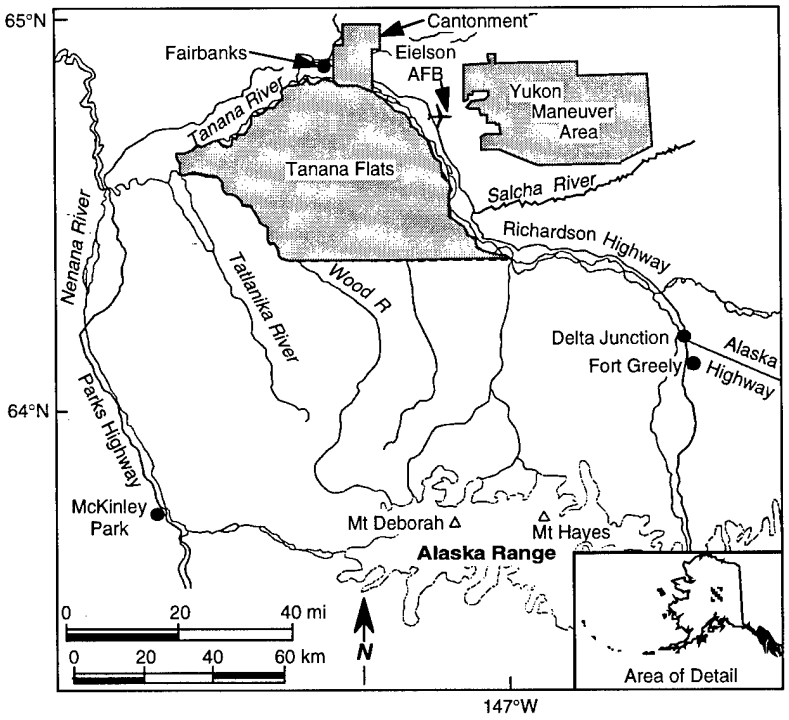

Figure 1. Location map of Fort Wainwright Military Installation near Fairbanks, Alaska, and the three major subdivisions of the base (Yukon Maneuver Area, Tanana Flats, and cantonment) with inset map showing location in Alaska.

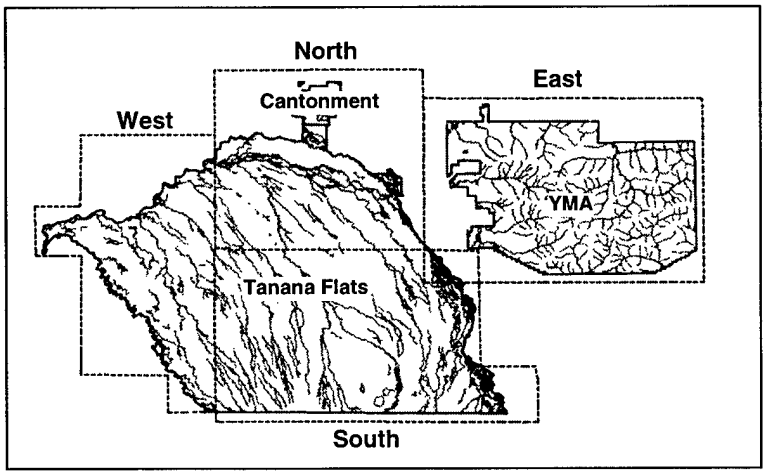

Figure 2. Locations of the four Defense Mapping Agency 1:50,000 installation maps (north, south, east, and west) used as the basis for this study.

Figure 3. Aerial oblique photo looking north across the Tanana River toward the Yukon–Tanana Uplands, Fairbanks, and the cantonment area of FWA dominated by buildings, lawns, road, and other disturbed habitats.

Flats Wood River area)" (Fig. 2). A total of 13 USGS 1:63,360-scale maps are required to cover the entire base area (Fairbanks B1, B2, B3, C1, C2, C3, C4, D1, D2; Big Delta B6, C5, C6, D6). The 370,445-ha (915,000-acre) installation can be divided into three major regions: the cantonment, the Yukon Maneuver Area, and Tanana Flats (Fig. 1 and 2). The cantonment and Yukon Maneuver Area (YMA) are separated from Tanana Flats by the large floodplain of the Tanana River (Fig. 3 and 4).

Most base facilities and services are located in the cantonment area on the eastern edge of the city of Fairbanks (Fig. 1 and 3). It extends south from Birch Hill to the Tanana River, including a section of the Chena River, and covers about 6075 ha (15,000 acres). The Fairbanks Permafrost Experiment Station is an outlier of the cantonment area and is located on the west side of the Steese Expressway northwest of Birch Hill.

The YMA occupies about 1042 km^2 (260,000 acres) east of Eielson Air Force Base in an area south of the Chena River lowlands, extending south to the Salcha and Little Salcha Rivers (Fig. 5). The YMA is bounded by the headwaters of Moose and French Creeks on its western slopes, Ninety-Eight Mile Creek and the Salcha River on the south, and the South Fork of the Chena River and Beaver Creek on the north. Like the Tanana Flats, the area is largely remote, but the YMA does have a limited road and trail network.

The largest of the two major training areas is the Tanana Flats–Blair Lakes Air Force Range south of the Tanana River covering over 257,200 ha (620,000 acres) (Fig. 6). Tanana Flats occupies an area between the Tanana and Wood Rivers (Fig. 1), extending south to Blair Lakes. The area is also drained by Bear, Clear, Willow, and Crooked Creeks. There are no roads, so it is largely accessible only by helicopter. Airboats have limited access from the major rivers.

Climate

The Fairbanks area is characterized by a continental climate with extreme seasonal variations in temperature (Pewe and Reger 1983). The mean annual temperature is –3.28°C (26.1°F); the record high temperature is 37.2°C (99°F), and the record low temperature is –55°C (–66°F).

The transition from winter to summer and vice versa is rapid. The average last date of freezing temperatures is May 21, and the average date of frost reoccurrence is August 30, giving a growing season of approximately 100 days. The first frost of the season in 1995 had not occurred before the

Figure 4. View up the Tanana River floodplain separating the Yukon Maneuver Area and the cantonment from the Tanana Flats areas of FWA. Note braided channels and islands in early stages of plant succession, and late-successional riparian spruce forests that parallel the river. The river here approximates the boundary between the Yukon–Tanana Uplands and Tanana Flats.

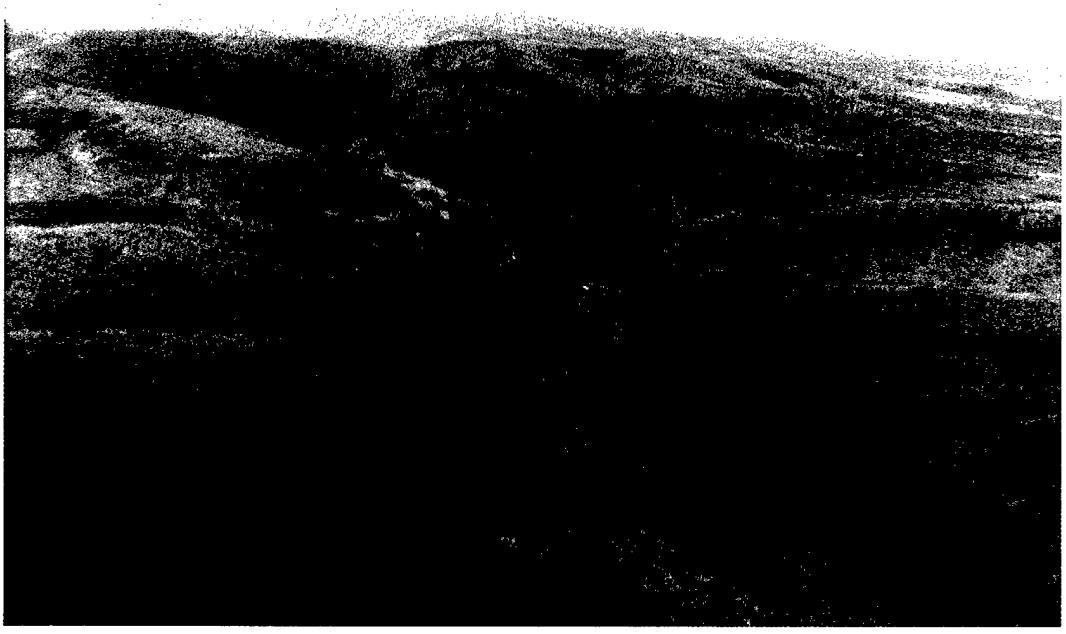

Figure 5. Aerial oblique photo of the Yukon Maneuver Area (YMA) in the Yukon–Tanana Uplands consisting of rolling hill and valley topography. Black spruce/bog vegetation occupies darker valley and lower slope areas with greener deciduous (birch and aspen) forests on the upper slopes.

Figure 6. Aerial oblique view of Tanana Flats looking south toward Clear Creek Butte (right) and the Alaska Range along the route of the Bonifield Trail, an old trail used for winter training maneuvers.

end of the field season on August 31; however, lowland depressions were displaying fall colors by August 20.

Annual precipitation for the Fairbanks area is 297 mm (11.7 in.). Rains usually begin in May and reach a maximum in August, followed by a noticeable decline in precipitation from September through December. Average annual snowfall is 1692 mm (66.6 in.). Snows begin as early as September (Racine and Walters 1991).

Geology and soils

The Quaternary geology and geomorphology of the Fairbanks area have been summarized by Pewe et al. (1966), Pewe (1975), and Pewe and Reger (1983). The country rock is Birch Creek schist, a Precambrian formation consisting mainly of folded and strongly jointed quartz mica and quartzite schist (Pewe et al. 1966). Exposures of granitic or ultramafic intrusives also occur locally as rock outcrops. A series of tors is characteristic of nonforested alpine domes (hilltops) in the eastern part of the YMA.

Although the Fairbanks area itself has never been glaciated, hundreds of meters of sand and gravel were deposited in the Tanana floodplain during periods of maximum glaciation (Pewe and Reger 1983). These deposits have since been covered by finer sand and silt carried by the glacier-fed Tanana River. Glaciers that originate in the Alaska Range still contribute to the heavy silt load carried by the Tanana today.

Quaternary, micaceous loess deposits mantle the uplands. The thickness of this layer varies with elevation, exposure, and distance from the plains. Since the original depositions, much of the material has been redeposited on the lower slopes and upland valleys.

Fort Wainwright lies within the Yukon–Tanana Upland and the Tanana–Kuskokwim Lowland geographic divisions of Wahrhaftig (1965). The latter includes Tanana Flats (Pewe 1975).

The broad, flat floodplains of the Tanana River and its major local tributary, the Chena River, comprise a large part of the area and maintain vast expanses of peatlands. The Tanana River approximates the boundary between the two major geographic divisions of the study area and occupies a system of anastomosing channels sometimes split around islands and in other places braided (Fig. 2). Seasonal or perennial side channels enclose densely vegetated islands, some of which are stable for decades or centuries (Viereck et al. 1993).

Tanana Flats in the Tanana Lowland is a nearly level terrain sloping gradually north from the foothills of the Alaska Range to the Tanana River. It is

broken by small, isolated, bedrock knobs that protrude through ancient accumulations of glacial and fluvial sediments from the Alaska Range (Fig. 6). Examples of these features include the Wood River Buttes and Clear Creek Butte.

Rounded, even-topped ridges or domes with gentle to steep side slopes characterize the Yukon–Tanana Upland geographic division north of the Tanana River (Wahrhaftig 1965) (Fig. 5). The ridges in the eastern part of the YMA have numerous rock outcrops and granite tors. Valley bottoms are generally flat and 0.4–0.8 km (0.25–0.5 mi) wide within a few kilometers of the headwaters. The transition from lowland to hillslope in both geographic sections is, in most cases, quite abrupt.

Floodplain elevations range from 123 m (370 ft) at the mouth of the Wood River in the western part of the study area to the domes of the YMA that border the floodplain to the east, which attain elevations of 996 m (3265 ft).

Soils of the Fort Wainwright area have been mapped and described in a broad exploratory level of survey (Rieger et al. 1979). On south-facing slopes, soils are generally well drained and free of permafrost, while poorly drained north-slope soils are usually underlain by permafrost. South slopes are occupied by well-drained silt loams that grade from shallow, gravelly silt near ridgetops through silt loams of the midslopes to deep, moist silt loams of the lower slopes. Drainage bottoms and depressions are occupied by shallow, gravelly silt loam with a thick overlying peat layer and underlying permafrost. Soils of north-facing slopes are shallow, gravelly silt loams with thick cover and permafrost.

The greater portion of the YMA is rolling to hilly upland, covered by silt loam soils developed in the silt mantle of hills and ridges bordering the Tanana River valley. Stratified, silty to gravelly stream-deposited materials occupy low terraces adjoining the Tanana and Chena Rivers. Soils developed in these materials are well-drained, alluvial silty and sandy loams.

Wet depressions and much of Tanana Flats and the Chena River lowlands are covered by thick peat deposits presumably underlain by permafrost. Polygonal ground, thaw lakes, pingos, and other expressions of permanently frozen ground were observed in these areas.

Vegetation

The vegetation of Alaska has been classified by Viereck et al. (1992); they have summarized and described many of the vegetation types on FWA. The Tanana River Basin Cooperative Study, involving the USDA Soil Conservation Service, the U.S. Fish and Wildlife Service, and the State of Alaska Department of Natural Resources, produced detailed vegetation maps and resource inventories of the Tanana Basin during the 1980s (SCS/DNR 1990). Land-cover mapping was conducted at a scale of 1:31,680 for over 56,680 km^2 (14,000,000 acres), including all of FWA. These land-cover maps were digitized into a GIS for 11 of the 14 USGS 15-minute quadrangles covering FWA. In this effort, 97 cover types were mapped using an earlier version (1984–86) of the Viereck vegetation classification system. National Wetland Inventory (NWI) maps (1:63,360 scale) were also derived from this same mapping effort but have not yet been digitized into GIS coverages.

In general, the vegetation of Fort Wainwright is a mosaic of forest, grassland, shrub, bog, fen, and alpine tundra types that have formed primarily as a result of slope, aspect, elevation, parent material, permafrost, and succession following wildfire (Viereck et al. 1986). Because of the dry continental climate and low sun angle, there is a great contrast in the vegetation of north-facing vs. south-facing slopes. This is particularly evident in the forested slopes of the YMA (Fig. 5) and on the buttes of Tanana Flats. The presence or absence of permafrost, closely correlated with slope and aspect, has also been shown to be a dominant factor in the distribution of vegetation types (Dyrness and Grigal 1979). Because of a high frequency of fires in interior Alaska (Gabriel and Tande 1983, Viereck 1973), most of FWA tends to be in successional stages, masking the factors that control the distribution of more mature vegetation types. A more detailed description of the vegetation types is provided in Appendix A of this report.

METHODS

Preliminary checklist development

A list of vascular taxa that could potentially occur within the study area was compiled from prior studies in the region (the starred references in the Selected Bibliography). The Northern Plant Documentation Center (Herbarium, University of Alaska Museum) also provided a list of collections for an area centering on FWA (Batten 1995). Interviews were conducted with area and regional ex-

perts, in particular, Herbarium staff at the University of Alaska Museum* and researchers from the Institute of Northern Forestry, U.S. Forest Service, Fairbanks† (Foote 1992, 1995).

This preliminary checklist was used as a guide throughout the collecting season to determine collection priorities.

Subdivision of base for site selection

The overall approach of this study was first to recognize the range of environmental variation on Fort Wainwright in order to select collecting sites that represent this range of variation. Prior to the field season the base was first divided into large regional areas representing the major climate–physiographic-disturbance areas. These include Tanana Flats (TF), the Yukon–Tanana Uplands (YMA), the Tanana River floodplain, and the cantonment described above (Fig. 1). These areas were then further subdivided into collecting units representing the range of variation within each region (Fig. 7 and 8). Floristic collection units were predetermined by CRREL and WES staff in consultation with AKNHP scientists to ensure representative sampling of the study area over the collecting season. The inventory units represented a combination of logistical considerations and biological and physical features that included vegetation, topography, watershed, elevation, geology, and soils.

The *cantonment area* is distinguished by major disturbances associated with the base housing, support facilities and services, and airfields on the eastern edge of the city of Fairbanks (Fig. 1 and 5). Areas here are largely artificially cleared or disturbed, including powerlines, roadsides, railroad rights-of-way, borrow pits, ski areas, and other human-modified areas. Agronomic and weedy plant species not necessarily present in other areas of the base would therefore be expected to occur here more than in other areas. Other areas in the cantonment (outside of the area between the Chena and Tanana Rivers) are less developed but could be disturbed in the future; they include lowlands associated with the Chena River and uplands around Birch Hill.

The second geographic region of FWA is the *Yukon Maneuver Area* (YMA) where three floristic collection units were recognized based mainly on elevation (Fig. 7):

1. Lowlands unit—Consisting of the Chena River lowlands and valley bottoms up to an elevation of approximately 229 m (750 ft) on the

*Personal communication, A. Batten, D.F. Murray, and C. Parker.

†Personal communication, J. Foote and L.A. Viereck.

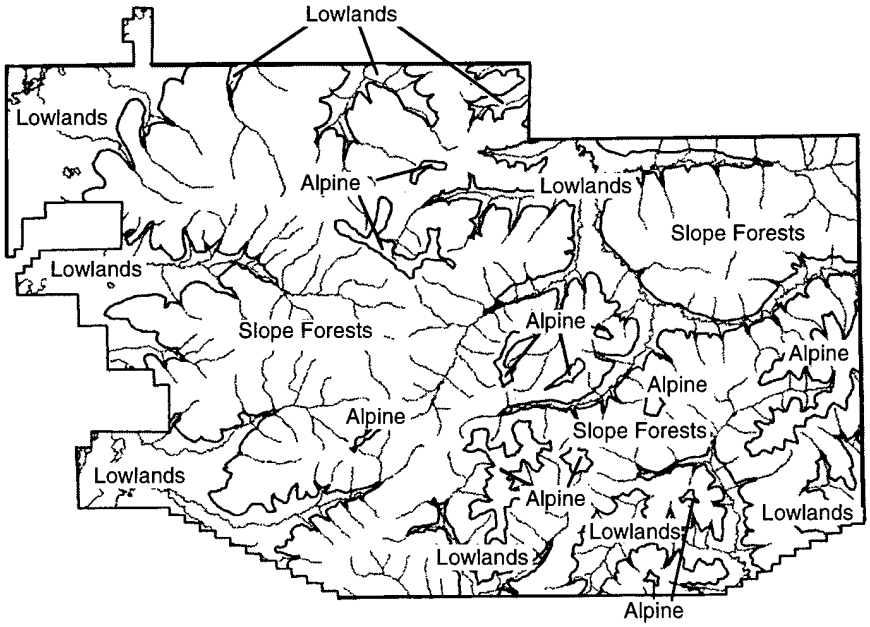

Figure 7. Floristic inventory units based mainly on elevation within the Yukon Maneuver Area in the Yukon–Tanana Uplands.

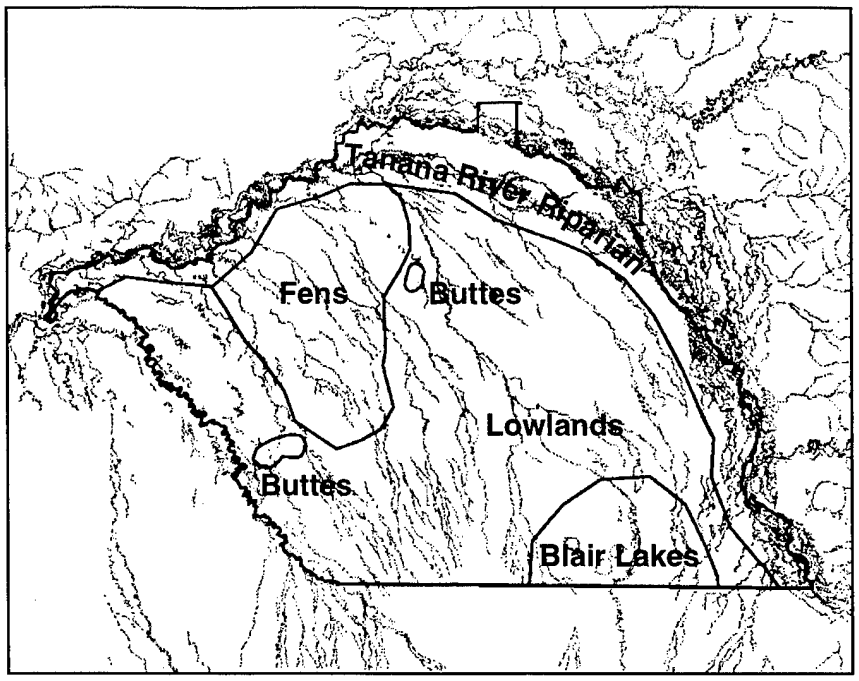

Figure 8. Subdivision of Tanana Flats into floristic inventory units based mainly on landforms.

western portion of the YMA and 381 m (1250 ft) on the east (Fig. 5 and 7). In the northeast corner of the YMA, the Lowlands unit includes the Chena River lowlands. In this area, the relatively flatter valley terrain abuts the abruptly steeper Slope Forests unit (Fig. 5).

2. Slope Forests unit—The most extensive area in the YMA; it includes slopes from the treeline downslope to approximately 229 m (750 ft) on the western side and 381 m (1250 ft) on the east, where most slopes intercept the abruptly flatter Lowlands unit terrain (Fig. 5).

3. Alpine unit—Several isolated summits occurring from treeline at approximately 685 m (2250 ft) to summits as high as 996 m (3265 ft) on the east side of the YMA (Fig. 9).

Five subdivisions of the *Tanana Flats area* were recognized based mainly on the types of landforms present (Fig. 8):

1. Blair Lakes unit—An upland area at the southern edge of the Tanana Flats representing an area surrounding three large lakes (Blair Lakes) and a series of low hills near the southeastern boundary of Tanana Flats (Fig. 10).

2. Buttes unit—A small unit consisting of the Wood River Buttes and Clear Creek Butte. These isolated knobs of igneous and metamorphic bedrock project abruptly from the surrounding alluvial Lowlands unit (Pewe 1975) (Fig. 11 and 12). Although small in total area, these features are significant because of their xeric, south-facing, nonforested slopes that contain steppe-like communities.

3. Fens unit—A wetland area in the northwest corner of Tanana Flats comprising a unique area of wetland fens (Racine and Walters 1994) consisting of extensive, floating, vegetated mats (Fig. 13). The area lies northwest of Clear Creek Butte between Crooked Creek, Salchaket Slough, and the Tanana River.

4. Lowlands unit—The largest unit of Tanana Flats, formed from a complex of ancient alluvial fans that extend from the Alaska Range north to the Tanana River (Fig. 14). A low gradient and little topographic relief, coupled with the presence of permafrost and groundwater springs, results in large expanses of swampy, boggy wetlands surrounding the Fens, Buttes, and Blair Lakes collecting units.

5. Tanana River Floodplain unit—Area largely influenced by riverine processes paralleling the Tanana River and consisting of the channel islands, backwaters, floodplains, and terraces of the river (Fig. 4).

Figure 9. Alpine area (above 940 m elevation) on the east side of the Yukon Maneuver Area. Stunted white spruce is in the foreground. Note the numerous rocky tors along the ridgeline in the center of the picture.

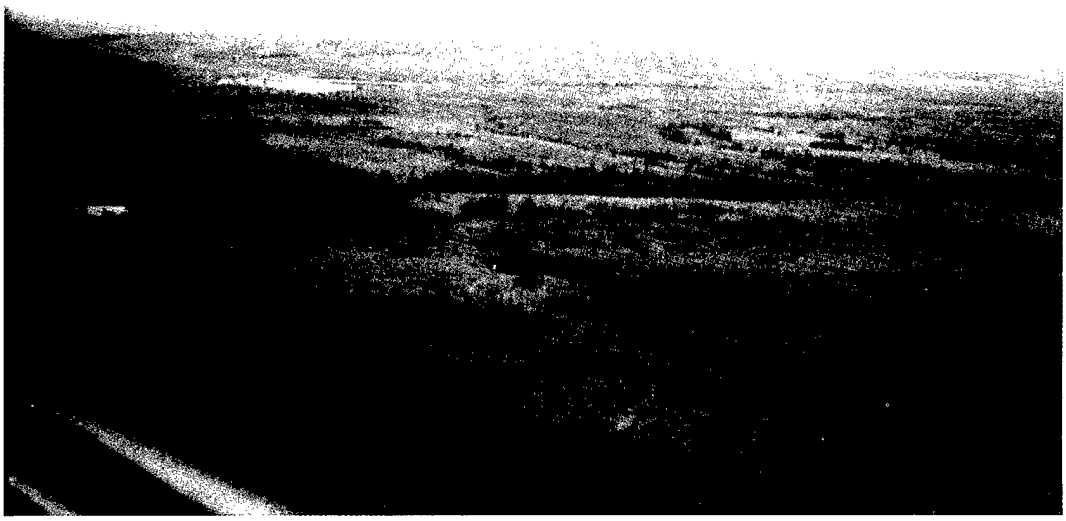

Figure 10. Blair Lakes floristic inventory unit on the Tanana Flats. Aerial oblique view of the Blair Lakes upland area where several large lakes occur surrounded by burned forests.

Figure 11. Aerial oblique view northwest across Tanana Flats to the south-facing grassland slopes of the Wood River Buttes.

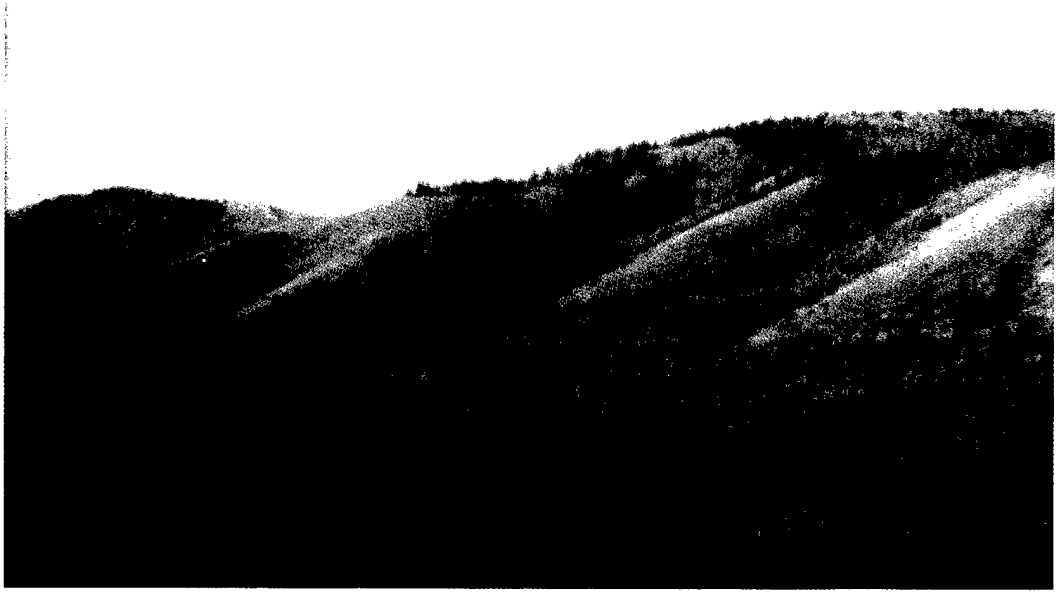

Figure 12. Buttes area of Tanana Flats, showing dry xeric–steppe habitats on south-facing slopes of the Wood River Buttes.

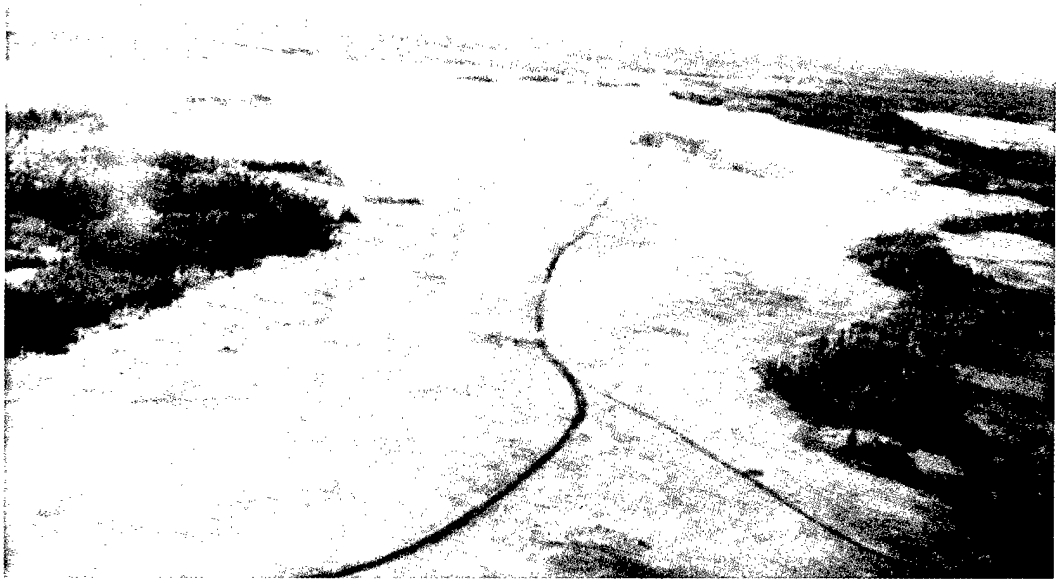

Figure 13. Fen floristic inventory area in the northwest corner of Tanana Flats. These floating mats occur as long linear corridors oriented southeast to northwest and support a graminoid forb community. An airboat trail runs down the center.

Figure 14. Tanana Flats Lowlands inventory unit. The view is south across the Lowlands floristic collection unit of Tanana Flats from the north end of Clear Creek Butte.

Figure 15. Typical bog lake on FWA that provides habitat for aquatic plant species. Note the aquatic community of yellow water-lily (Nuphar polysepala). *A shrub birch* (Betula nana)*–sweet gale* (Myrica gale) *low-shrub bog community is visible on a floating mat in the lower foreground.*

Selection of inventory sites by vegetation and habitat type

Within a floristic collection unit, it was desirable to search for as many different vegetation types and specialized habitats as possible given the constraints of field logistics, time, resources, and accessibility. Therefore, specific inventory sites were selected by habitat and vegetation type. All of the vegetation types and specialized habitats within each floristic inventory unit were not necessarily sampled.

Special attention was given to those vegetation types and habitats that were considered unique or significant to a specific collection unit. Within the Buttes unit, for example, widespread forest types of FWA were surveyed less intensively than the south-facing grassland communities, which were considered unique to this unit. The specialized habitats of each unit included, but were not necessarily limited to

1. Aquatic and bog communities—Lowlands units in YMA and Tanana Flats (Fig. 15);
2. Dry, south-facing, nonforested slopes (steppe-like communities)—The Buttes unit of Tanana Flats and in the cantonment;
3. Forests over slope, elevation, and aspect gradients—The Slope Forests unit of YMA;
4. Alpine/subalpine plant communities—The Alpine units in YMA;
5. Riverine processes—The Tanana Floodplain unit of FF;
6. Artificially cleared or disturbed areas—The cantonment area;
7. Bog lakes, burned forest, and foothills species—The Blair Lakes unit of Tanana Flats.

Site access and location

Plant inventories were conducted between 12 June and 15 September, 1995. The road and trail systems near Fairbanks, in the YMA, and on the cantonment provided relatively easy access by truck, all-terrain vehicle, and foot and allowed us to revisit areas to obtain vascular plant specimens in full flower. Helicopter support provided access to Tanana Flats throughout the field season. Much of the Flats was searched for specific and unique habitats while traveling by helicopter to predetermined sampling sites.

Access to various parts of the base was limited by field logistics and helicopter availability. Various portions of the installation were also closed to entry due to training maneuvers, unexploded ordnance, and communications installations. In these instances, specialized habitats were visited in

neighboring areas to ensure adequate coverage for that portion of the base.

Each inventory site was assigned a number and drawn onto one of the four DMA 1:50,000-scale topographic maps of Fort Wainwright (Fig. 2) in one of three different shapes: 1) an *area* where most of the ground within an area was searched, 2) a *point* where only a very small area or ground point was searched, and 3) a *line* where searching occurred only along a traverse line, trail, or road. Inventory sites were located on these maps using color infrared aerial photography (1:60,000) and topographic maps. Two handheld GPS (global positioning system) units (Garman and Magellan) were employed to navigate the base and aid in locating inventory sites.

Site data collection

Searches for plant species not previously seen or collected were conducted at each site. As the season progressed, fewer collections were made at each new site, and at several inventory sites no collections were recorded. Each collection was assigned a collection number, and this number together with the site number and habitat descriptions were entered into a notebook in the field and later into a computerized spreadsheet.

Physical and biological features of each inventory site were described and recorded. Physical features included topography (slope and aspect), moisture regime (wet, moist, or dry), soils (loess, peat, gravel, sand, clay, etc.) and geology (if known). Vegetation types at each site were noted and described to Level IV of Viereck et al. (1992). For each vegetation type, a list of associated species and abundances were also noted. These data were used in producing the labels for herbarium and field specimens.

Database construction

A spreadsheet database was compiled daily from the collection and site data described above. The location and shape of each collecting site visited during the day were also drawn onto the 1:50,000-scale map. At the end of the field season, the site area, point, or line representing each collecting location was digitized from this map into an ARC/INFO geographic information system at CRREL. A site number was assigned to each site, and the number of species collected at each site was input as an attribute. A lookup table showing a list of species collected at each site was also constructed and entered into the ARC/INFO system. These databases enable the natural resource managers to determine where plant collections have been made as part of the floristic inventory and search the database for species collected in different areas of the base. It also permits a compilation of the inventory areas covered. The specimens collection list and collection-site species lists were also used to construct a matrix of observed species by floristic collection unit. Site records of rare plants (Element Occurrence Records) were prepared and added to the AKNHP Biological and Conservation Database (BCD).

Identification and verification of specimens

Specimens collected by field botanists were identified in several steps. Many of the specimens were collected and tentatively identified during the collection season using local keys (Hulten 1968) for vascular plants and other references. All specimens were ultimately verified by staff at ALA with known specimens to ensure proper identifications.

Specimens and labels

Whenever possible, enough specimens of each species were collected to permit triplicate sheets for vascular plants and duplicates for common cryptogams. At the end of each field day, the vascular plant specimens were placed in standard plant presses and dried under moderate heat with electric plant driers for a minimum of two days.

Cryptogam specimens were collected in paper packets or paper bags on which collection notes were placed. Wet specimens were very lightly pressed in a standard plant press in the laboratory within a day of collection. Cryptogams were air dried and stored in field packets. When dry, specimens were packeted for further processing. Specimens were sorted into groups (lichens and bryophytes), preliminary identifications were made, and standard data for the production of herbarium labels were entered in a computer.

Collections from the study were prepared as various types of specimens. For vascular species, two sets of each species were developed into herbarium specimens and one set into laminated mounts. Laminated specimens were intended to be used in the field as reference material during Land Condition Trend Analysis (LCTA) sampling. One set of specimens is retained at ALA as a voucher set for the study, and the other two sets (one laminated and the other herbarium-mounted) are stored at Fort Wainwright for reference. The primary set of cryptogam specimens is archived with labels at the Herbarium of the University of Alaska Museum. A second labelled set of common ground cryptogam species was prepared in plastic petri dishes for use in LCTA studies at FWA.

Plant nomenclature

The nomenclature or plant names for both vascular and cryptogam species in this report are based on the University of Alaska Museum Alaska Plants database (ALABASE), which is not available to the public and is unpublished but is based on the latest taxonomic revisions of the various plant groups and the Flora of North America (FNAEC 1993). As a result of these recent revisions 50–60 of the vascular plant names provided in the checklists are different from the names of the same plants used in Hulten (1968). Where the names have changed, the Hulten name is given in brackets with an equal sign. If a name in Hulten still does not match a name in the checklist, two other authorities can be checked to determine the most recent name for that plant: Kartesz (1994) and the NRCS Plants database available over the Internet at http://plants.usda.gov.

RESULTS

Inventory sites

For the vascular plant inventory, 120 sites were visited over the course of the study. Actual collections were made at approximately 100 of these sites. The sites are listed using site identification numbers subdivided by floristic region (Table 1) and by map area (Appendix B). Appendix B also shows the number of collections made, the shape of the inventory site (area, point, or line), and whether or not cryptogams were also collected. The maps in this section were produced by the Geographic Information System to show the locations of each of the inventory sites.

Thirty-one sites were inventoried for vascular plants in the cantonment area (Fig. 16, Table 1); cryptogams were also collected at six of these sites. An additional 38 sites were visited in the YMA with cryptogams collected at 10 of them (Fig. 17). Fifty-one sites were visited on Tanana Flats–Tanana River floodplain areas (Blair Lakes, Buttes, Fens, Lowlands). Because of its large size, the Tanana Flats–Floodplain area was subdivided into four areas, and maps were produced for each (Fig. 18–21). Cryptogams were also collected at 17 of the 51 sites in the Tanana Flats–Tanana River floodplain areas.

Vascular collections

During the field season, 1005 collections were completed, representing 227 genera in 72 families. The 491 taxa (including subspecies and varieties) collected and identified are listed in Appendix C (alphabetical) and D (by family). Although the floristic survey cannot be considered 100% complete, the vascular plant species lists presented in Appendix C and D provide an excellent basis for describing the flora of the Fort Wainwright military

Table 1. Floristic inventory site numbers where collections were made during 1995 listed by floristic subdivision of FWA. ( ) indicates sites that overlap between two sudivisions. NC indicates the number of additional sites visited where no collections were made.

	Tanana Flats					*YMA*			*Cantonment*		
	Low-land	*Fen*	*Butte*	*Lakes*	*Flood-plain*	*Low-land*	*Slope*	*Alpine*	*Low-land*	*Slopes*	*Dis-turbed*
	36	49	2	30	43	16	26	12	11	10	1
	37	67	3	31	44	17	52b	13a	19	15	27
	38	68	4	32	51a	18	72	13b	21	20	46
	39		5	64	51b	22	88	13c	23	29	57
	41		6	65	51c	47	89	14	24	42	59
	(43)		7		70	52a	90	25	28	48	60
	(44)		8		74	53c		71	33		66
	(67)		9		77	53b			45		75
	(68)		34		78	54			50		76
	80		35		79	55			58		
	81		40		83	56			61		
	82		69		84	73			62		
	(85)		87		85	91			63		
	86					93			92		
						(72)					
TOT	14	3	13	6	13	14	6	7	15	6	9
NC	1	1	1			3	4	4			1

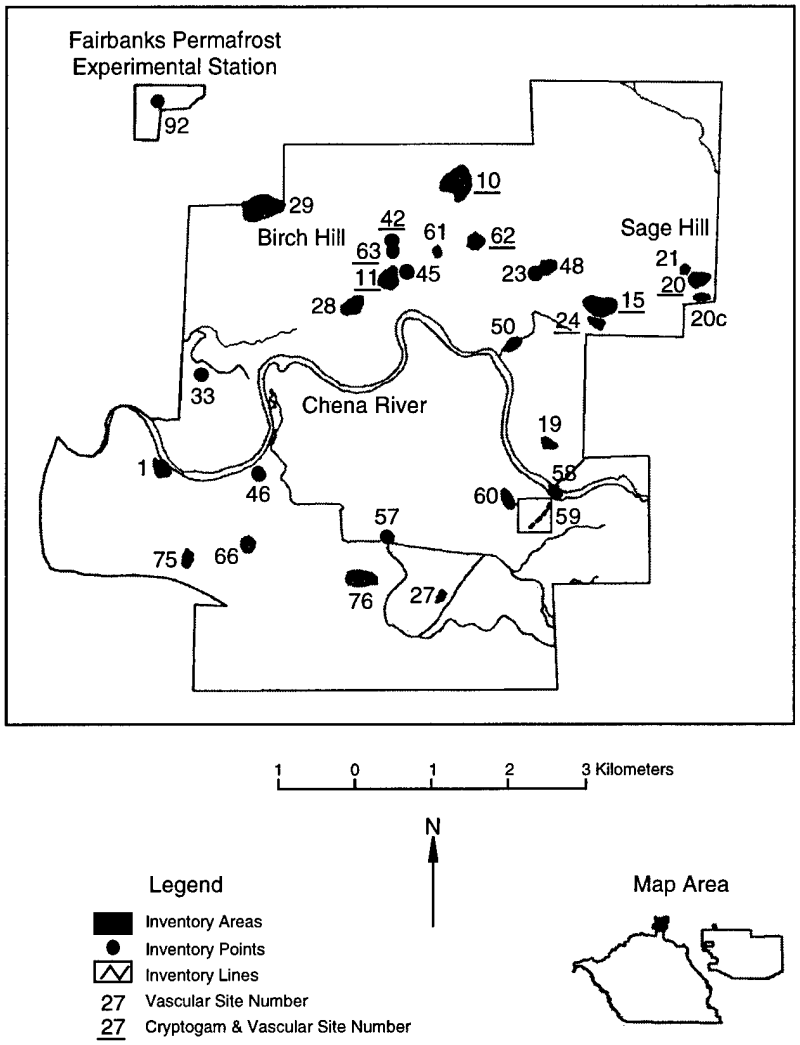

Figure 16. Locations of floristic inventory sites in the cantonment area of FWA.

installation. Nomenclature for vascular plants follows that used by the Herbarium of the University of Alaska Fairbanks.

Cryptogam collections

About 218 cryptogam taxa (species and subspecies) were collected and identified, including 115 taxa of lichens, 11 taxa of hepatics, and 91 taxa of mosses, listed in Appendix E. Most of these are common ground-inhabiting species. Nomenclature follows the most recent North American checklists: Esslinger and Egan (1995) for lichens, Stotler and Crandall-Stotler (1979) for hepatics, Anderson (1990) for *Sphagnum* species, and Anderson et al. (1990) for mosses (see List of References Useful for the Identification of Boreal Cryptogams at the end of this report).

The *lichen* collections represent about 30 families (of which three stand out in importance: Peltigeraceae, Cladoniaceae, and Parmeliaceae), 66 genera, and 109 identified species, or 115 when infraspecific taxa are included.

Hepatics, or liverworts, which are usually inconspicuous and scattered, were little studied; about 13 families, 20 genera, and 11 common or conspicuous species have been identified.

The *moss* records include 30 families, with Sphagnaceae the most frequently recorded group, followed by Amblystegiaceae and Dicranaceae. About 75 genera and 95 species were identified.

Appendix F provides a list of the major ground-inhabiting lichens and mosses in each of several habitats on Fort Wainwright. These habitats include disturbed sites, fens, lake and pond margins, wet sedge meadows, and peatlands, including treed peatlands, forests, steppe, and tundra.

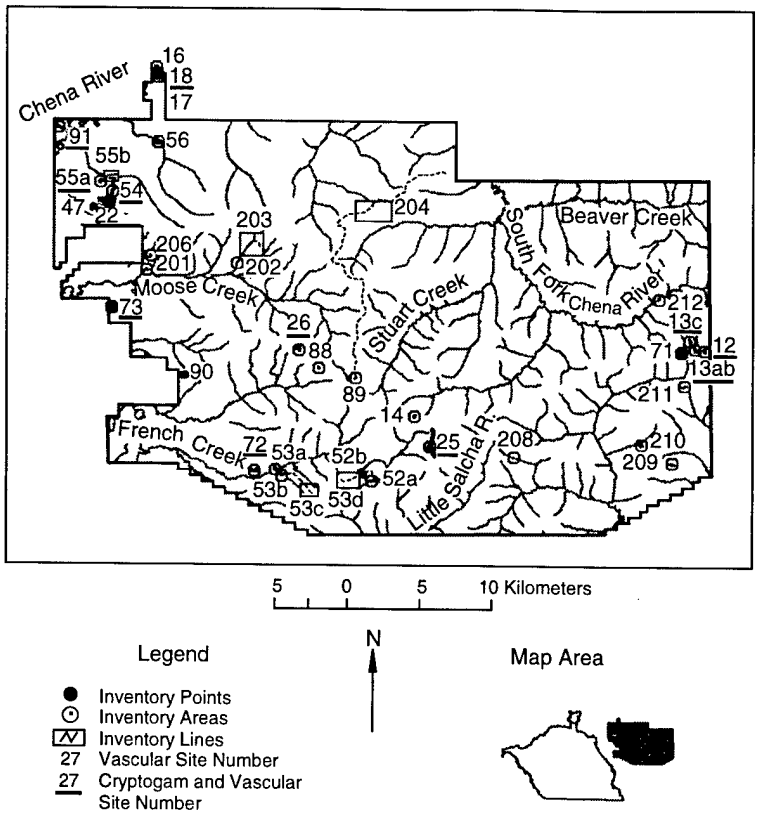

Figure 17. Locations of floristic inventory sites in the Ft. Wainwright Yukon Maneuver Area.

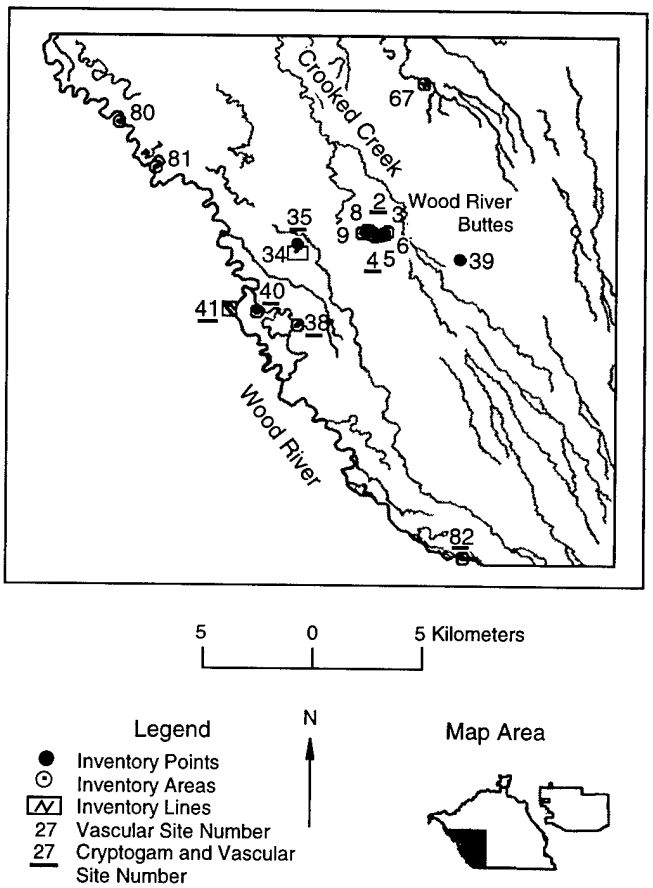

Figure 18. Locations of floristic inventory sites in the southwest section of Tanana Flats.

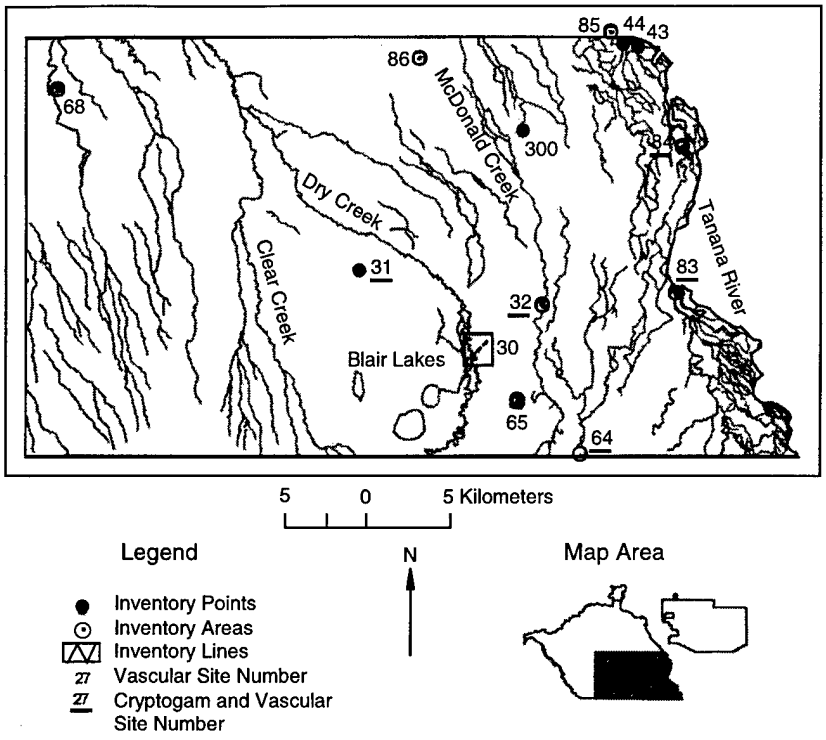

Figure 19. Locations of floristic inventory sites in the southeast section of Tanana Flats.

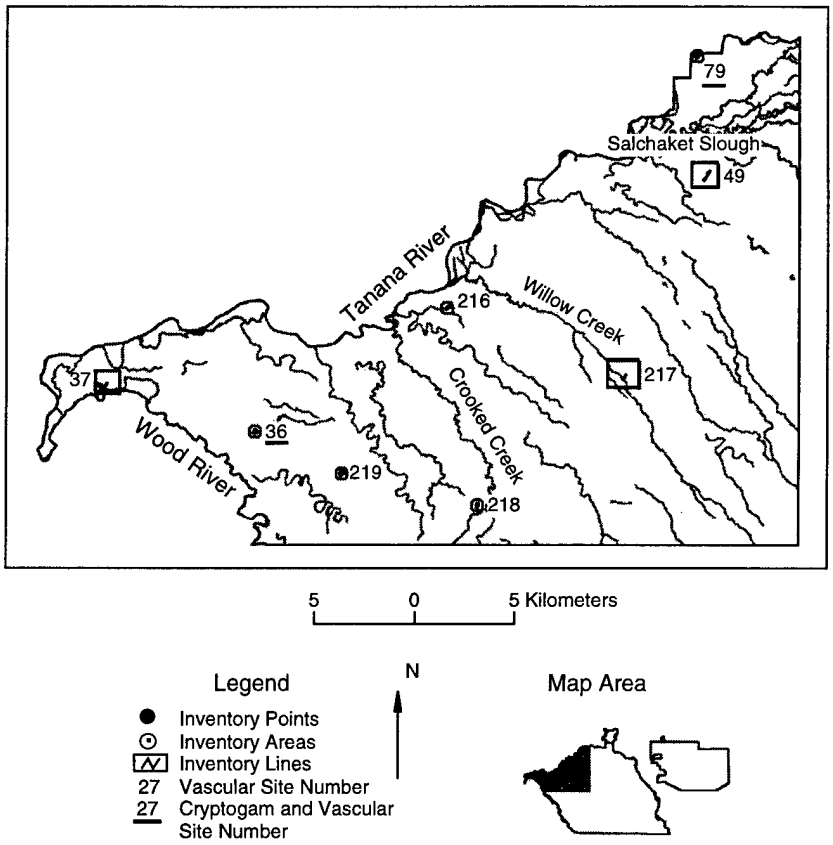

Figure 20. Locations of floristic inventory sites in the northwest section of Tanana Flats.

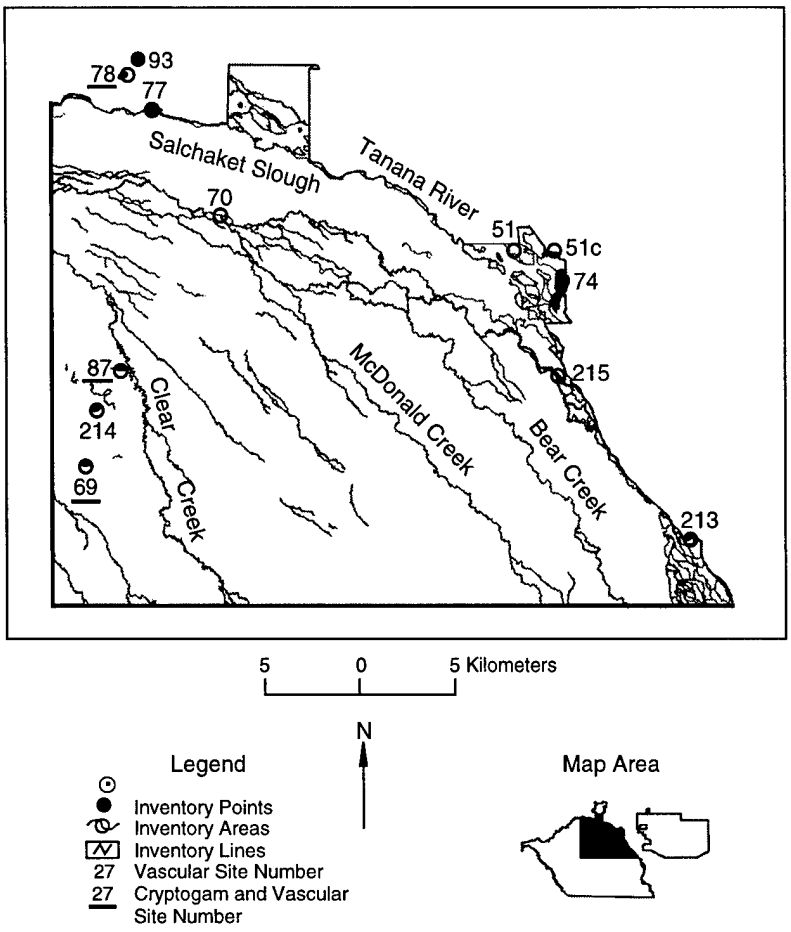

Figure 21. Locations of floristic inventory sites in the northeast section of Tanana Flats.

DISCUSSION

Inventory coverage

The maps (Fig. 16–21) and the list of inventory sites in Appendix B show that the sites well represent the range of environmental and geographic variation on FWA. Inventory sites occur in all of the major floristic subdivision units and across a broad range of special habitats and elevations. Table 2 shows that at least 63 of the 97 vegetation cover types mapped for the Tanana Valley (SCS/DNR 1990) were inventoried in at least one of these floristic regions. Many of these were surveyed repeatedly throughout the summer and across the various floristic inventory units.

Vascular floristic affinities

The flora of Fort Wainwright is typical of the boreal region of interior Alaska and reflects the range of habitats found there. Many of the prominent species that give the forest its character are restricted to the North American boreal forest. These include *Picea glauca, P. mariana, Betula papyrifera, Viburnum edule,* and *Mertensia paniculata.* Some common taxa, however, are circumboreal in distribution, ranging across the boreal forest in North America and Eurasia. Examples of this element include *Rosa acicularis, Betula nana, Vaccinium vitis-idaea,* and *V. uliginosum.*

Two of the more distinct elements of the flora of Fort Wainwright are the taxa of alpine areas and the taxa found on xeric sites, especially the steppe-like vegetation of steep, south-facing bluffs.

The alpine flora on FWA includes about 80 species, but it is relatively species-poor in comparison with other alpine areas of interior Alaska and includes only 80 taxa, less than half of which were also found in other regions of FWA. Most of the species of this distinctive azonal element are widespread across the arctic and alpine regions and include species such as *Dryas octopetala, Hierochloe alpina, Loiseleuria procumbens,* and *Pedicularis*

Table 2. Vegetation classes inventoried for vascular flora on Ft. Wainwright, Alaska, by geographic division and site number. x indicates that vegetation type is present but no collections were made there.

	Geographic Division and Collection Unit, March 1996										
	Tanana Flats of the Tanana Lowland Unit					*Yukon–Tanana Upland Unit*					
						Low-lands		*Slope forests*			
	Low-lands	*Fens*	*Buttes*	*Blair Lakes*	*Tanana River riparian*	*FBX*	*YMA*	*FBX*	*YMA*	*Alpine*	*Canton-ment area*
LEVEL IV VEGETATION TYPE (Viereck et al. 1992)											
I. FOREST											
A. Needleleaf forest											
1. Closed needleleaf forest											
j. White spruce	X		X	30	79,83,84	X	18	X	X		X
k. Black spruce	X			X	X	X	92	X	X		
l. Black spruce–white spruce			X	X		X	X	X	X		
2. Open needleleaf forest											
e. White spruce			X	X	43	11		X	X		
f. Black spruce	38		34	X	X	24	52,53	X	52,53		
g. Black spruce–white spruce	X			X		X	X	X	X		
3. Needleleaf woodland											
c. White spruce									X	X	
d. Black spruce	37	X		30	X	X	X				
B. Broadleaf forest											
1. Closed broadleaf forest											
c. Balsam poplar			3		X	X					X
d. Paper birch	X	49	X	X	44	45	17,22,91	10	X		
e. Quaking aspen			8	X				10,15	X		X
2. Open broadleaf forest											
a. Paper birch	X		X	X					X	X	
C. Mixed forest											
1. Closed mixed forest											
a. Spruce–paper birch	X		3,35,40	X	X	23	X	29	X		
e. Balsam poplar–white spruce				32	X						
2. Open mixed forest											
a. Spruce-paper birch			2	X	X	19		X	26		
II. SCRUB											
A. Dwarf tree											
2. Open dwarf tree scrub											
a. Black spruce	X	X		X	X	X	X				
B. Tall scrub											
1. Closed tall scrub											
a. Willow	X	X			X	X	X				
b. Alder	X	X		X	70	X	X	10	X		
c. Shrub birch	X	X		X	X	X	X			X	
d. Alder–willow	X	X		X	X	X	X		X	1	
2. Open tall scrub											
a. Willow	37,41	X			44,74	X	X	20			
b. Alder	80	X		30,31	43,93	X	X				
c. Shrub birch											X
f. Shrub swamp	X	X				X	X				
C. Low shrub											
2. Open low scrub											
b. Mixed shrub-sedge tussock bog	X	X		30		X	22				
f. Shrub birch–willow	X	X		X		X	22				
i. Willow–graminoid shrub bog	X	X		X	X	X	73				

Table 2 (Cont'd). Vegetation classes inventoried for vascular flora on Ft. Wainwright, Alaska, by geographic division and site number. x indicates that vegetation type is present but no collections were made there.

	Geographic Division and Collection Unit, March 1996										
	Tanana Flats of the Tanana Lowland Unit					*Yukon–Tanana Upland Unit*					
						Low-lands		*Slope forests*			
	Low-lands	*Fens*	*Buttes*	*Blair Lakes*	*Tanana River riparian*	*FBX*	*YMA*	*FBX*	*YMA*	*Alpine*	*Canton-ment area*
j. Sweetgale–graminoid	X	X		X	85	X	X				
m. Sagebrush–juniper			X					X	X		
n. Sagebrush–grass			2,4,8 9,34					15,20	X		
D. Dwarf scrub											
1. Dryas dwarf scrub											
a. Dryas tundra										13	
b. Dryas–sedge tundra										71	
c. Dryas–lichen tundra										12,13,25	
2. Ericaceous dwarf scrub											
a. Bearberry tundra										X	
b. Vaccinium tundra										12-14	
3. Willow dwarf scrub											
a. Willow tundra										X	
III. HERBACEOUS											
A. Graminoid herbaceous											
1. Dry											
b. Dry fescue			X					X	X		
c. Midgrass–shrub			2–9,34, 40,69	32,64				15,20, 42	72		
2. Mesic											
a. Bluejoint meadow	X		34,87	64	X		22				46
h. Sedge–willow tundra										X	
j. Sedge–dryas tundra										X	
3. Wet											
a. Sedge meadow tundra										25	
d. Fresh sedge marsh	X				74		X				76
f. Subarctic lowland sedge–wet meadow	36–38	49,67	34	31,65	44	19,24	17,22, 47				
j. Subarctic lowland sedge–bog meadow	X	X	40,69	X	X	11,62	22				
k. Subarctic lowland sedge–moss bog meadow	39,86	49		X	44,85	61	54,55, 73	20	X		
B. Forb herbaceous							73				
1. Dry											
a. Seral herbs	X				74		X				X
b. Alpine herb sedge (snowbeds)										X	
c. Alpine herbs										X	
2. Mesic											
a. Mixed herbs	X	X		X	74	X	X	X	X	X	59
3. Wet											
a. Fresh herb marsh	X	68			X	X	X				
c. Subarctic lowland herb bog meadow	X	49		X	44	X	X				

Table 2 (Cont'd).

	Geographic Division and Collection Unit, March 1996										
	Tanana Flats of the Tanana Lowland Unit					*Yukon–Tanana Upland Unit*					
						Low-lands		*Slope forests*			
	Low-lands	*Fens*	*Buttes*	*Blair Lakes*	*Tanana River riparian*	*FBX*	*YMA*	*FBX*	*YMA*	*Alpine*	*Canton-ment area*
D. Aquatic											
1. Freshwater											
a. Pondlily	X	X		X	X	11	22				X
b. Common marestail	X	X		X	X	11	X				X
c. Aquatic buttercup	X	X	87	X	X	X	53			X	59
e. Water milfoil	X	67		X	X	11	17				X
f. Fresh pondweed	X	X		65	X	50, 61–63	17,22				76
Non-Viereck Classification Units Visited During a Floristic Inventory of Fort Wainright.											
B. Barren–natural											
1. Intermittent stream channels	81,82	X	34	X	51	X	16,17, 56	X	52	X	X
2. Sand, silt, or gravel bars	41,81,82		34	30	43,44,51, 70,74,77, 78,84,93		16,56				1
3. Rock			5,8,87	32				X	13,14		
C. Cultural											
1. Bare ground			X		51				11	X	27
2. Urban											59,60, 66,75
3. Gravel pits, quarries						11	X	15	X		27
4. Road, rail, powerline rights-of-way			X		51,74	23,28,33 28,33,50, 62	22,56, 73 48	10,15, 20,29,	26, 88-90	14	46,57, 60,75

capitata. A smaller number of the FWA alpine taxa are more restricted in range, a good example being the interior Alaskan endemic *Syntheris borealis*. Notable by their absence were other common alpine endemics of Alaska, such as *Claytonia scammaniana* and *Boykinia richardsonii*, and common, widespread, arctic–alpine species such as *Silene acaulis* and *Thalictrum alpinum*.

Steep, south-facing slopes in interior Alaska are known to contain a distinctive flora that many have seen as an analog of the steppe–tundra flora thought to have been widespread during glacial maxima 10,000–25,000 years ago. Some of the species found in these environments today are common members of the regional flora, but many of the taxa are only found on xeric slopes or their equivalent, such as dry river terraces and gravels. The signature species of these xeric, steppic sites are the shrub *Artemisia frigida* and certain dry-site sedges and bunch grasses. On FWA the Wood River Buttes included species of the Asian steppe such as *Festuca lenensis* and *Carex duriuscula*, as well as North American grassland species such as *Elytrigia spicata* and *Carex filifolia*. Other species, such as *Calamagrostis purpurascens*, are wide-ranging across dry grasslands in the circumpolar area.

Wetland and aquatic habitats also display a distinct flora and species on FWA. Many of these species show a discontinuous distribution, reflecting the disjunct nature of their habitat across the boreal region as well as being an artifact of the limited collecting usual in this habitat. As additional surveys document the flora of wetlands in Alaska and Canada, many of these species that were previously thought to be disjunct or rare in their distribution are now proving to be more common or continuous in their range. Examples from FWA

include *Myriophyllum verticillatum, Hammarbya paludosa,* and *Lysimachia thyrsiflora.*

Vascular floristic richness

Although 491 vascular species and subspecies were inventoried on FWA, this number is considerably less than the 582 taxa collected on Fort Richardson near Anchorage in 1994. The FWA vascular flora represents 26% of the 1960 species listed in Hulten (1968) as compared with 30% on Fort Richardson. Moreover, Fort Richardson only covers 5% of the land area covered by FWA. There are several reasons for the greater vascular plant richness on Fort Richardson: Fort Richardson contains elevations from sea level up to 1650 m (5300 ft) including coastal salt marsh and higher alpine areas, which undoubtedly adds to the vascular diversity. However, more important to the higher diversity on Fort Richardson is the proximity of the base to three biogeographic regions, each with distinct floristic elements: southeastern Alaska, interior Alaska, and the Aleutians.

Vascular plant range extensions

The floristic inventory found a number of range extensions for species and several new locations for rare taxa. Using the maps in Hulten (1968) as a base for vascular plant distributions of Alaska, many of the taxa collected could be considered new to the Fairbanks area. A number of these are introduced or have escaped from cultivation, and others are minor, peripheral range extensions or connections. The following 10 vascular taxa may be considered to be significant range extensions of more than 150 km (90 mi), according to Hulten (1968):

1. *Alisma triviale* (water plantain). This semi-aquatic species had been collected previously in interior Alaska, but the collection was never published. It is disjunct by hundreds of kilometers from its main range in boreal North America but is likely to prove more common as more aquatic sites are investigated. This species was collected at three lake sites (20, 23, 73) in the YMA.

2. *Carex Krausei* (Kraus's sedge). This collection fills a gap between its northern and southern ranges in Alaska. The species was collected at two floodplain sites on Tanana Flats (74, 82).

3. *Cicuta bulbifera* (bulb-bearing water hemlock). This water hemlock is known from only two other collections in Alaska, one near Anchorage in south central Alaska, and an earlier (unpublished) collection from Fort Wainwright. This species may also prove to be more common as additional collections are made in aquatic sites in interior Alaska. The species was collected at four lake sites (61, 67, 68, 70).

4. *Drosera anglica* (long-leaved sundew). The Fort Wainwright collections of this species represent a significant extension from the nearest location in Hulten (1968). It is likely to be more common. This sundew was found at one site near Horseshoe Lake in the YMA (54).

5. *Hammarbya paludosa* (bog adder's mouth). We now have several additional locations for this bog orchid species in interior and southern Alaska, although it seems to have a very discontinuous distribution. It is an easily overlooked orchid but is never reported as common. On FWA, the species was collected at three sites, one in each of the three subdivisions of FWA (72, 45, 49).

6. *Pedicularis macrodonta* (small-flowered lousewort) (including *P. parviflora* ssp. *parviflora*). This species was found on floating bog and fen mats in Tanana Flats. These collections extend this lousewort's range to the north (85, 86, 44).

7. *Potentilla arguta* (white cinquefoil). This species is typically found on dry bluff sites and is rare in Alaska. Prior to its collection at one site on the Wood River Buttes (3) it was known only from sites to the south and near the Canadian border.

8. *Potentilla virgulata*. This is another dry-site species found at FWA on the south-facing Birch Hill Bluff (15) in the cantonment area. This record fills a large distribution gap between its southern and northern ranges.

9. *Rorippa curvisiliqua*. This cress is rare in Alaska and otherwise known only from the southeast portion of the state. In FWA it was collected at only one site near Salmon Load (87), a small hill in Tanana Flats.

10. *Rosa woodsii* (wood rose). This is a rare species of dry sites. On FWA a single location for this species was found on a bluff near Blair Lakes (32). It is otherwise known in Alaska from less than five sites in the interior. It has been collected (but not reported) from the Bonanza Creek bluff across the Tanana River.

Cryptogam range extensions

Among the cryptogam collections were two aquatic hepatics with significant range extensions: *Ricciocarpos natans,* for which there are few records in Alaska, and *Riccia fluitans,* previously unreported in Alaska. Both seem to be quite frequent, floating among vascular plants at lake margins, particularly in the Tanana Flats fen area.

Vascular rare species records

None of the vascular taxa inventoried on FWA are listed by the U.S. Fish and Wildlife Service as endangered or threatened and none were listed on their Category 2 candidate list (which is no longer being maintained). However, the inventory located several populations of rare plants being tracked by the AKNHP. Most of the rare taxa were found on xeric sites (dry bluffs or river gravels) or in wetland (especially aquatic) habitats. These areas (and alpine sites) are often the habitats where rare species are found in Alaska. The taxa are briefly discussed below together with the National Heritage Program ranking at the global (G) and state (S) levels; the number after the G or S indicates the ranking at each level.* Many species that are globally secure may be rare at the state level.

1. *Artemisia laciniata* G5 S2: An Asian species closely related to *A. laciniatiformis*, both of which are rare in Alaska, being known from several dry interior bluff sites or open woodlands. On FWA it was collected at two sites including Sage Hill (20) in the cantonment and at Wood River Buttes (40).

2. *Carex crawfordii* (Crawford's sedge) G5 S2S3: A species of dry sites and roadsides, this sedge is slowly being found at additional sites and may prove to be more common than now believed. Collected at four sites (11, 22, 36, 73) in the cantonment area.

3. *Ceratophyllum demersum* (hornwort) G5 S1S2: Now known from at least five locations in Alaska, this aquatic species will likely be found at additional sites.

4. *Cicuta bulbifera* (bulb-bearing water hemlock) G5 S1S2: Previously known in Alaska from only two locations, one near Anchorage and the other on Fort Wainwright.

5. *Cryptogramma stelleri* G5 S2S3: A fern known from an increasing number of sites in Alaska, but always reported to be rare. Collected at two sites (61, 76) in the cantonment area.

6. *Dodecatheon pulchellum* ssp. *pauciflorum* (few-flowered shooting star) G5T5Q S2: A distinctive subspecies found on dry sites, especially south-facing bluffs; this taxon will likely be found to be more common. Collected at two sites on the Wood River Buttes (4, 2).

7. *Lycopus uniflorus* (northern water horehound) G5 S3: Although relatively common in parts of southeast Alaska, this species is restricted to a few disjunct locations in interior Alaska. Collected at one site near Blair Lakes (65).

8. *Oxytropis tananensis* (Tanana locoweed) G3 S3: A distinctive endemic found on dry gravels and xeric bluffs of interior Alaska, this species is restricted to a small geographic area, though it is often common on the sites where it is found. Collected at a disturbed site (46) on the cantonment.

9. *Rorippa curvisiliqua* G5 S1: This mustard is apparently very rare in Alaska and is mostly known from a few sites in southeast Alaska.

10. *Rosa woodsii* (wood rose) G5 S1S2: A very distinctive rose found on dry bluffs and in woodlands along rivers. It is only known from a few other sites in eastern interior Alaska. Found on only one dry bluff site near Blair Lakes (32).

11. *Syntheris borealis* G3G4 S3S4: A distinctive endemic of moist alpine sites in interior Alaska, it is not uncommon within its limited range.

CONCLUSIONS

Of the over 100 sites visited and inventoried for vascular and ground-inhabiting cryptogam species on FWA, several stand out as being very diverse or containing rare species. These sites and the species they contain should be protected. Examples of such sites containing good representation of the dry steppe flora are Sage Hill (20) and East Birch Hill (15), both in the cantonment area. Gravel mining presently threatens both of these areas. In addition, small ponds (known as the Duck Ponds) at the base of Birch Hill were floristically diverse in terms of aquatic–wetland species and also contain a number of rare vascular species.

Alpine areas in the YMA are relatively rare and are being developed as assault strip training areas. Site 25 in Figure 17 is one such example. Although these areas do not support a very diverse alpine flora, they add significantly to the total floristic diversity of FWA.

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*1 = critically imperiled because of extreme rarity; 2 = imperiled because of rarity; 3 = very rare and local throughout the range; 4 = apparently secure; 5 = demonstrably secure; T = global rank of described subspecies or variety; Q = uncertainty about taxonomic status that might affect global rank.

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APPENDIX A: VEGETATION TYPES ON FT. WAINWRIGHT, INTERIOR ALASKA

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Forest vegetation

Upland forest types of the Tanana Flats and the YMA vary from highly productive aspen (*Populus tremuloides*), paper birch (*Betula papyrifera*), and white spruce (*Picea glauca*) on south-facing, well-drained slopes, to slow-growing, moss-dominated black spruce (*Picea mariana*) forests on north-facing slopes, lowlands, and lower slopes that are generally underlain by permafrost (Viereck et al. 1986).

Highly productive floodplain forests of balsam poplar (*Populus balsamifera*) and white spruce occur on recently formed river alluvium where permafrost is absent. In these riparian situations, young stages of revegetation are dominated by willow (*Salix* spp.) and alder (*Alnus* spp.) thickets, intermediate stages by extensive stands of balsam poplar, and the later stages by well-developed stands of white spruce (Viereck 1989).

Black spruce may be the most widespread forest type on the base. Upland black spruce occupies north slopes at all elevations, and ridgetops and most slopes above 400 m (1200 ft) in elevation (Viereck et al. 1983). It is especially widespread in the rolling uplands of the YMA where loess deposits are shallow over bedrock.

Lowland black spruce occupies old terraces of the major rivers, small valley bottoms, and the lower slopes along small drainages in the uplands. Lowland black spruce types are wetter, and *Sphagnum* mosses and *Eriophorum vaginatum* tussocks become more abundant in older stands. Also, tamarack (*Larix laricina*) occurs occasionally along with scattered paper birch. The forested areas tend to be interspersed with bogs, lakes, and old stream channels supporting a variety of aquatic plant communities.

Treeline and alpine vegetation

Treeline vegetation in the YMA is characterized by open stands of black and white spruce that grade into alder and willow tall-shrub thickets and hummocky, low-shrub birch (*Betula glandulosa*) communities. Alpine dwarf shrub plant communities are typically found on the treeless ridge crests and domes at elevations above 685 m (2250 ft) and consist of plants capable of withstanding very low temperatures and short growing seasons. Much of this alpine zone is covered by a crowberry (*Empetrum hermaphroditum*)/blueberry (*Vaccinium uliginosum*) dwarf shrub tundra. These dominant species intermingle; however, shallow, stony, fairly well-drained soils support blueberry tundra at slightly higher elevations than crowberry tundra. Blueberry tundra sites are generally exposed to the wind and do not accumulate much snow in the winter but usually are not as exposed as sites supporting *Dryas*–sedge–lichen tundra (Viereck et al. 1992). Crowberry tundra occurs in more protected areas at slightly lower elevations on thin, well-drained, mineral soil or poorly drained peats.

A *Cassiope* dwarf shrub tundra (*Cassiope tetragona*) occurs on moist sites, commonly on north-facing slopes or snow accumulation areas. It is found on sites well-protected by snow in winter that become snow-free in the early to middle part of the growing season (Viereck et al. 1992).

On the other end of this moisture gradient, occupying exposed, wind-swept, alpine sites, are species of the genus *Dryas* that form mats a few centimeters thick and have a strong sedge and lichen component. Exposure to strong winds leads to deflation of fines and organic material producing various-sized mats or islands of this *Dryas*–sedge–lichen dwarf shrub tundra along many of the higher ridges and slopes in the YMA. Ridgelines of the highest alpine areas are also characterized by tors. These rock outcrops are sparsely vegetated by alpine herbs, lichens, and mosses.

Shrub–scrub vegetation

Nonforested sites at lower elevations are occupied by a wide variety of plant communities, many of which may be successional to forested site types. Alder (*Alnus tenuifolia, Alnus viridis*) and willow (*Salix bebbiana, Salix* spp.) shrub communities are very important successional species on exposed river bars, old alluvial deposits of creeks and rivers (Mann et al. 1995, Viereck 1989), and disturbed sites such as old trails and clearings. They also occur in openings of spruce and birch forests and become the dominant vegetation where they intermingle with spruce forests and dwarf birch low-shrub types at treeline.

Peatlands

Much of the Chena River lowlands and Tanana Flats are characterized by treed and treeless bog and fen wetland types. Some are dominated by *Sphagnum* mosses, some by *Eriophorum vaginatum* tussocks, and some by mixtures of sedges (*Carex* spp.) and grasses. They may be completely treeless or have widely scattered black spruce, paper birch, and occasional tamarack. Much of the vegetation of the Tanana Flats is a complex mosaic of such stunted forests and expanses of dwarf birch low-shrub communities heavily influenced by beaver activity and wildfire (Racine and Walters 1994).

Calmes (1976) described three major bog types from the Fairbanks area. The first type is a *Sphagnum* bog dominated by a moss layer of *Sphagnum* and with an important shrub component of dwarf birch, bog rosemary (*Andromeda polifolia*), and narrow-leaf Labrador tea (*Ledum palustre* ssp. *decumbens*). *Sphagnum* bog types generally develop a substrate of sedge and *Sphagnum* peat that may form a floating mat on water along the shoreline of lakes and ponds.

A second bog type, found on wetter sites, is dominated by several species of sedges (*Carex* spp.) and grasses and is nearly devoid of shrubs. *Sphagnum* mosses are present but are much less important than in the *Sphagnum* bog. There is a gradual transition from *Sphagnum* bogs to sedge meadows on progressively wetter sites.

A third and widespread type of bog is dominated by tussocks of *Eriophorum vaginatum* similar to those found in many parts of more northerly arctic and alpine tundra areas. Low shrubs of *Ledum palustre* ssp. *decumbens, Vaccinium uliginosum, Vaccinium vitis-idaea, Betula nana, Betula glandulosa,* and *Salix* spp. are common in the tussock type. Vast portions of the Tanana Flats are covered by such dwarf birch–tussock sedge bogs.

A unique area in the northwest corner of the Tanana Flats is covered by groundwater discharge "fens" recently described by Racine and Walters (1994). These areas contain highly productive, floating vegetation mats made up of narrow-leaved graminoids and broad-leaved forbs that possess little or no *Sphagnum* moss or woody plant species. Fens occur as both large open expanses and long linear corridors 100–500 m (300–1500 ft) wide and oriented southeast to northwest in the northwestern portion of the study area (Fig. 13) and are used extensively by airboats.

Xeric steppe

In sharp contrast with the waterlogged conditions of these treed and treeless bog and fen types are xeric sites on steep, south-facing bluffs (Fig. 22). These are found on the Wood River Buttes (Fig. 12), Clear Creek Butte, and Blair Lake hills on the Tanana Flats, and bluffs adjacent to the Chena River floodplain along the base of Birch and Sage Hill. Steppe-like communities exist on some of these sites that are too dry for tree growth and are dominated by sagebrush (*Artemisia frigida*), juniper (*Juniperus communis*), and grasses and forbs that include *Calamagrostis purpurascens, Festuca lenensis, Elytrigia spicata, Pulsatilla patens, Cnidium cnidiifolium,* and *Antennaria rosea*.

Disturbed vegetation

Artificially cleared and disturbed areas are common on the base, especially in the cantonment area (Fig. 24). In general, vegetation on artificially cleared or disturbed sites is not well organized into discrete plant communities. Instead, the vegetation consists of a heterogenous mix of a wide variety of native and introduced plant species, the composition of which varies considerably from place to place over relatively short distances. This heterogeneity is in part due to soil and site conditions, which range from relatively undisturbed native soils to shallow topsoil over coarse textured fill to deep fill without topsoil. In addition, management of these areas has been a combination of varying degrees of soil disturbance, introduction and spread of numerous introduced forage plants and weeds, and natural revegetation by native plants, all coupled with periodic mowing or other forms of manmade disturbances.

Natural soils, which have been cleared long ago and subsequently received little additional disturbances, may exhibit distinct vegetation communities. These include alder and willow shrub, bluejoint (*Calamagrostis canadensis*) meadow, balsam poplar scrub, and mesic forb types consisting of native plants characteristic of early to mid-seral forests.

At the other extreme are periodically disturbed areas that tend to be dominated more by native and introduced weeds. Tickle grass (*Agrostis scabra*), foxtail barley (*Hordeum jubatum*), bluegrass (*Poa pratensis*), clovers (*Trifolium* spp.), common dandelion (*Taraxacum officinale*), knotweed (*Polygonum aviculare*), pineapple weed (*Matricaria matricariodes*), and a number of other species are very common.

APPENDIX B: LIST OF COLLECTING SITES FOR THE FLORISTIC INVENTORY ON FT. WAINWRIGHT, ALASKA

The sites are grouped by DMA map area of Ft. Wainwright (Fig. 2), including the Yukon Maneuver Area (west map), cantonment and northern part of Tanana Flats (north map), southern part of Tanana Flats (south map), and Wood River area of the Tanana Flats (west map).

Table B1. Floristic inventory site locations and characteristics for FWA DMA map East.

Site no.	*Type**	*DMA Map East Yukon Maneuver Area*	*No. col.*	*Elev. (m)*	*Crypto.*
12	A	High point at end of Brigadier Road	57	945	X
13ab	A	E boundary, granite tors along Brigadier Road	29	915	X
13c	A	E boundary, granite tors along Brigadier Road (near ABR no. 8)	13	915	X
14	A	Jct. of Johnson and Brigadier Roads	7	730–870	0
16	A	N end MOUT site, Chena R.	19	150	0
17	A	N end MOUT site, E side Transmitter Road, 0.7 km S of Chena R.	23	150	0
18	A	N end MOUT site, E side Transmitter Road, 0.75 km S of Chena R.	15	150	X
22	A	Horseshoe Lake, W of Transmitter Road, 8 km N of Eielson AFB entrance	61	190	X
25	A	4 km E jct. Johnson & Brigadier Roads	18	825	X
26	A	Quarry, 5 km E jct. Manchu & Quarry Roads	13	580	X
43	P	West bank of Tanana River, 7 km SSW of Eielson Airfield (near ABR no. 6)	16	180	X
44	P	West bank of Tanana River, 7 km SSW of Eielson Airfield	17	180	X
47	P	SW corner of Husky Drop Zone	1	190	0
52a	A	Tributary of Little Salcha R., E of Charlie Battery	4	365	0
52b	P	Tributary of Little Salcha R., E of Charlie Battery	1	365	0
53a	A	French Creek	1	245	0
53b	A	French Creek	2	245	0
53c	L	French Creek	0	245	0
53d	L	French Creek	0	245	0
54	A	Small pond 1.5 km NNE of Horseshoe Lake	4	180	X
55a	A	Small pond 2 km N of Horseshoe Lake	5	180	X
55b	L	Small pond 2 km N of Horseshoe Lake	0	180	0
56	A	Drained beaver pond at Transmitter Road, 0.5 km S of Chena R.	4	200	0
71	A	Ridgetop 1 km W of end of Brigadier Road	3	940	0
72	A	French Creek	4	275	X
73	A	Manchu Lake	8	175	X
85	A	W bank Tanana River approx. 7 km SSW of Eielson AFB	4	175	0
88	A	Bravo Mike Site, Manchu Road	1	640	0
89	A	1 km N of junction Manchu and Skyline Roads	2	550	0
90	P	Mile 0.75 km Quarry Road	1	345	0
91	A	W end of Chena River oxbow, 2 km W of N end	4	190	X
201	A	Moose Creek Lowland	0		
202	A	Moose Creek Valley	0		
203	L	Moose Creek Ridge	0		
204	L	Beaver Creek Road	0		
206	A	Moose Creek Ridge—above	0		
208	A	Headwaters of Ninety-Eight Creek	0		
209	A	Brigadier Road—high elevation	0		
210	A	Brigadier Road—high elevation	0		
211	A	Brigadier Road—high elevation	0		
212	A	Chena River South Fork—lowland	0		
213	A	Tanana River Floodplain	0		

*Type refers to point (P), line (L) or area (A) plant inventory type coverage depending on extent or shape of search area.

Table B2. Floristic inventory site locations and characteristics for FWA DMA map North.

Site no.	*Type*	*FT Cantonment-N, Tan. Flats*	*No. col.*	*Elev. (m)*	*Crypto.*
1	A	Chena R. Glass Park, near Airport Road	23	140	0
10	A	Central Birch Hill, 4 km N of airfield, S of beacon, Birch Hill Road	19	290	X
11	A	S of Ft. Wainwright Birch Hill Ski Area	72	140	X
15	A	Birch Hill Bluffs (3.5 km NE of airfield)	24	170–260	X
19	A	Homestead Road Bluff, 0.5 km NE of golf course	14	150	0
20	A	Sage Hill Bluff, 4.5 km NE of airfield	17	150–165	0
21	A	Sage Hill Road jct., 4.5 km NE of airfield	9	160	0
23	P	1 km W of Birch Hill Bluff	22	140	0
24	A	S of Birch Hill Bluff	32	135	X
27	A	Borrow pit, SE edge of Cantonment Area	5	140	0
28	A	N side of Ft. Wainwright landfill	12	140	0
29	A	Birch Hill	9	230–235	0
33	P	Trainor Gate Road	11	140	0
42	P	Birch Hill ski lift area	1	140	X
45	P	Birch Hill ski lift muskeg	8	140	0
46	P	Gaffney Road at W end of runway	6	120	0
48	A	Birch Hill, 2 km W of downhill ski area	5	140	0
49	L	Birch Island 4 km SE of mouth of Salchaket Slough (ABR no. 1)	12	130	0
50	A	Small pond 1.5 km NW of Approach Hill	5	140	0
51ab	A	Chena River flood control dike	17	150	0
51c	A	Chena River flood control dike	6	150	0
57	P	Corner of Santiago and Neely Streets	2	120	0
58	A	Chena River at Tank Road Bridge	4	120	0
59	L	Drainage ditch between Chena Road and Montgomery Road	12	120	0
60	A	S end of golf course at Montgomery Road	9	120	0
61	A	Duck Pond no. 3, 1 km E of ski lodge	4	140	0
62	A	Duck Pond no. 4, 1.5 km E of ski lodge	8	140	X
63	P	Small pond 300 m E of ski lodge	1	140	X
66	A	Cooling pond SW of power plant	13	120	0
69	A	Southernmost tip of Clear Butte	4	150	X
70	A	Salchaket Slough, 6 km SSW of Meridian Island	7	130	0
74	A	Tanana River at Chena flood control area	17	150	0
75	A	End of White Street	4	120	0
76	A	Montery Lake	11	120	0
77	A	Tanana River island, upstream of International Airport	3	135	0
78	A	Tanana River shoreline S of Peger Road	1	135	X
79	A	S of Tanana River from Rosey Creek	3	120	X
87	A	small hill 2 km N of Clear Creek Butte (near ABR no. 2)	4	150	X
92	P	Fairbanks Permafrost Experiment Station	1	145	0
93	P	S side of Peger Road, N side of river	1	140	0
214	A	Clear Creek Butte	0		
215	A	Salchaket–Tanana confluence	0		

Table B3. Floristic inventory site locations and characteristics for FWA DMA map South.

Site no.	*Type*	*South DMA Map Tanana Flats–Blair Lakes*	*No. col.*	*Elev. (m)*	*Crypto. col.*
30	L	Dry Creek valley, between Blair Lakes hills (ABR no. 4)	17	240	X
31	P	Blair Lakes, 4 km N of westernmost lake	11	200	X
32	A	Blair Lakes hills, McDonald Creek bluff	6	230	X
39	P	bog 4 km SE of Wood River Buttes (near ABR no. 11)	3	185	0
64	A	Escarpment 10 km ESE of Blair Lakes	8	290	X
65	A	Easternmost Blair Lake	13	265	0
68	A	Small lake 20 km S of Clear Butte	3	150	0
82	A	Wood River S of Wood River Buttes	5	200	X
83	A	W side Tanana River, W of Flag Hill	4	215	X
84	A	W side Tanana River, SW of Salcha River bluff	7	190	X
86	A	Small round lake 16 km W of Salcha River bluff	1	175	0
300	P	Head of McDonald Creek	0		

Table B4. Floristic inventory site locations and characteristics for FWA DMA map West.

Site no.	*Type*	*West DMA Map Tanana Flats–Buttes Area*	*No. col.*	*Elev. (m)*	*Crypto.*
2	A	Wood River Buttes (45 km SSW of Fairbanks), E bluff, highest pt.	11	320	X
3	A	Wood River Buttes (45 km SSW of Fairbanks), E bluff, 50 m E of highest point	35	300	X
4	A	Wood River Buttes (45 km SSW of Fairbanks), E bluff, 250 m E of highest point	4	240	X
5	A	Wood River Buttes (45 km SSW of Fairbanks), E bluff, 500 m E of highest point	5	275	0
6	A	Wood River Buttes (45 km SSW of Fairbanks)	2	275	0
7	A	Wood River Buttes (45 km SSW of Fairbanks)	2	240	0
8	A	Wood River Buttes (45 km SSW of Fairbanks), 2nd bluff W of weather station	6	300	0
9	A	Wood River Buttes (45 km SSW of Fairbanks), westernmost S-facing slope	8	215	X
34	L	Wood River Buttes, western butte (ABR no. 4)	10	165	X
35	P	Wood River Buttes, western butte	2	165	X
36	A	Stabilized sand dunes, 10 km E of mouth of Wood R.	2	130	X
37	L	Wood River slough, 5 km NE of mouth of Wood R.	12	115	0
38	A	Wet meadow 4 km S of Wood River Butte West	9	170	X
40	A	Small butte 4 km SW of Wood River Butte West	5	170–185	X
41	L	Wood River, 7 km SW of Wood River Buttes	3	170	X
67	A	Beaver pond/meadow 12 km NNE of Wood River Buttes	5	150	0
80	A	Wood River, NW of Wood River Buttes	1	140	0
81	A	Wood River oxbow, WNW of Wood River Buttes	2	145	0
216	A	Lake between Crooked and Willow Creeks	0		
217	L	Willow Creek (near ABR no. 3)	0		
218	A	Lake near head of Crooked Creek	0		
219	A	Lake west of Crooked Creek	0		

APPENDIX C: ALPHABETICAL CHECKLIST OF VASCULAR PLANTS COLLECTED FROM FORT WAINWRIGHT MILITARY INSTALLATION, ALASKA, 1995

The nomenclature or plant names for both vascular and cryptogam species in this report are based on the University of Alaska Museum Alaska Plants database (ALABASE), which is not available to the public and is unpublished but is based on the latest taxonomic revisions of the various plant groups and the Flora of North America (FNAEC 1993). As a result of these recent revisions 50–60 of the vascular plant names provided in the checklists are different from the names of the same plants used in Hulten (1968). Where the names have changed, the Hulten name is given in brackets with an equal sign. If a name in Hulten still does not match a name in the checklist, two other authorities can be checked to determine the most recent name for that plant: Kartesz (1994) and the NRCS Plants database available over the Internet at http://plants.usda.gov. In some cases the name is new and does not have an equivalent in Hulten.

Achillea borealis Bong.
Achillea millefolium L.
Achillea sibirica Ledeb.
Aconitum delphinifolium DC.
Actaea rubra (Aiton) Willd.
Adoxa moschatellina L.
Agrostis scabra Willd.
Alisma triviale Pursh
Alnus tenuifolia Nutt. [= *A. incana* (L.) Moench ssp. *tenuifolia* (Nutt.) Breitung]
Alnus viridis (Vill.) Lam. & DC. ssp. *crispa* (Aiton) Turrill [= *A. crispa* (Ait.) Pursh ssp. *crispa*]
Alopecurus aequalis Sobol.
Alopecurus alpinus Smith
Alopecurus pratensis L.
Amelanchier alnifolia (Nutt.) Nutt.
Andromeda polifolia L.
Androsace septentrionalis L.
Anemone narcissiflora L. var. *monantha* DC.
Anemone parviflora Michaux
Anemone richardsonii Hook.
Antennaria friesiana (Trautv.) Ekman
Antennaria pulcherrima (Hook.) E. Greene
Antennaria rosea (D.C. Eaton) E. Greene
Anthemis cotula L.
Apocynum androsaemifolium L.
Aquilegia brevistyla Hook.
Arabis divaricarpa Nelson
Arabis hirsuta (L.) Scop.
Arabis holboellii Hornem.
Arabis lyrata L.
Arctagrostis latifolia (R. Br.) Griseb. var. *arundinacea* (Trin.) Griseb.
Arctophila fulva (Trin.) Andersson
Arctostaphylos uva-ursi (L.) Sprengel
Arctous alpina (L.) Niedenzu [= *Arctostaphylos alpina* (L.) Spreng.]
Arctous rubra (Rehder & E. Wilson) Nakai [= *Arctostaphylos rubra* (Rehder & E. Wilson) Fern.]
Arnica alpina (L.) Olin ssp. *attenuata* (E. Greene) Maguire
Arnica angustifolia M. Vahl [= *A. alpina* (L.) Olin ssp. *angustifolia* (M. Vahl) Maguire]
Arnica griscomii Fern. ssp. *frigida* (C. Meyer ex Iljin) S.J. Wolf [= *A. frigida* C. Meyer ex Iljin]
Artemisia alaskana Rydb.
Artemisia arctica Less.

Artemisia frigida Willd.
Artemisia furcata M. Bieb.
Artemisia laciniata Willd.
Artemisia tilesii Ledeb. ssp. *elatior* (Torr. & A. Gray) Hulten
Aster junciformis Rydb.
Aster sibiricus L.
Astragalus adsurgens Pallas ssp. *viciifolius* (Hulten) Welsh
Astragalus alpinus L.
Astragalus bodinii E. Sheldon
Athyrium filix-femina (L.) Roth
Avena fatua L.

Barbarea orthoceras Ledeb.
Beckmannia erucaeformis (L.) Host
Betula glandulosa Michaux
Betula hybrids
Betula nana L.
Betula papyrifera Marshall
Bidens cernua L.
Bistorta plumosa (Small) E. Greene [= *Polygonum bistorta* L. ssp. *plumosum* (Small) Hulten]
Bistorta vivipara (L.) Gray [= *Polygonum viviparum* L.]
Boschniakia rossica (Cham. & Schlecht.) B. Fedtsch.
Botrychium lunaria (L.) Sw.
Brassica rapa L.
Bromopsis inermis (Leysser) Holub [= *Bromus inermis* Leysser]
Bromopsis pumpelliana (Scribner) Holub ssp. *pumpelliana* [= *Bromus pumpellianus* Scrib. var. *pupellianus*]

Calamagrostis canadensis (Michaux) P. Beauv.
Calamagrostis inexpansa A. Gray
Calamagrostis lapponica (Wahlenb.) Hartman F.
Calamagrostis neglecta (Ehrh.) Gaertner
Calamagrostis purpurascens R. Br.
Calla palustris L.
Callitriche verna L. emend. Kutz.
Caltha natans Pallas
Caltha palustris L.
Calypso bulbosa (L.) Oakes
Campanula lasiocarpa Cham.
Campanula uniflora L.
Capsella bursa-pastoris (L.) Medik.
Caragana arborescens Lam.
Cardamine pratensis L. ssp. *angustifolia* (Hook.) O.E. Schulz
Carex aenea Fern.
Carex aquatilis Wahlenb.
Carex atherodes Sprengel
Carex bigelowii Torrey
Carex bonanzensis Britton
Carex brunnescens (Pers.) Poiret
Carex canescens L.
Carex capillaris L.
Carex capitata Sol.
Carex chordorrhiza Ehrh.
Carex concinna R. Br.
Carex crawfordii Fern.
Carex diandra Schrank
Carex disperma Dewey
Carex duriuscula C.A. Mey. [= *Carex stenophylla* Wahlenb. ssp. *eleocharis* (L. Bailey) Hulten]
Carex eleusinoides Turcz.

Carex filifolia Nutt.
Carex garberi Fern. ssp. *bifaria* (Fern.) Hulten
Carex krausei Boeckeler
Carex lasiocarpa Ehrh.
Carex leptalea Wahlenb.
Carex limosa L.
Carex magellanica Lam. ssp. *irrigua* (Wahlenb.) Hulten
Carex maritima Gunnerus
Carex media R. Br.
Carex microchaeta Holm ssp. *microchaeta*
Carex microchaeta Holm ssp. *nesophila* (Holm) D. Murray
Carex obtusata Lilj.
Carex oederi Retz.
Carex peckii Howe
Carex phyllomanica W. Boott
Carex podocarpa R. Br.
Carex rossii Boott
Carex rostrata Stokes
Carex rotundata Wahlenb.
Carex rupestris All.
Carex saxatilis L.
Carex supina Willd. ssp. *spaniocarpa* (Steudel) Hulten
Carex tenuiflora Wahlenb.
Carex utriculata F. Boott
Carex vaginata Tausch
Cassiope tetragona (L.) D. Don ssp. *tetragona*
Castilleja caudata (Pennell) Rebrist.
Castilleja elegans Malte
Ceratophyllum demersum L.
Chamaedaphne calyculata (L.) Moench
Chenopodium album L.
Chenopodium capitatum (L.) Asch.
Chenopodium hybridum L.
Chrysanthemum leucanthemum L.
Chrysosplenium tetrandrum (N. Lund) T.C.E. Fries
Cicuta bulbifera L.
Cicuta virosa L. [= *C. mackenzieana* Raup]
Circaea alpina L.
Cirsium arvense (L.) Scop.
Cnidium cnidiifolium (Turcz.) Schischkin
Collomia linearis Nutt.
Comarum palustre L. [= *Potentilla palustris* (L.) Scop.]
Consolida ambiqua (L.) P. Bass & Heyw.
Conyza canadensis (L.) Cronq.
Corallorrhiza trifida Chatel.
Cornus canadensis L.
Cornus canadensis × Suecica L.
Corydalis aurea Willd.
Corydalis sempervirens (L.) Pers.
Crepis elegans Hook.
Crepis tectorum L.
Cryptogramma stelleri (S. Gmelin) Prantl
Cypripedium guttatum Sw. ssp. *guttatum*
Cypripedium passerinum Richardson
Cystopteris fragilis (L.) Bernh.

Delphinium glaucum S. Watson
Deschampsia caespitosa (L.) P. Beauv.
Descurainia sophia (L.) Prantl

Descurainia sophioides (Fischer) O. Schulz
Dianthus barbatus L.
Diapensia lapponica L. ssp. *obovata* (F. Schmidt) Hulten
Dodecatheon pulchellum (Raf.) Merr. ssp. *pauciflorum* (E. Greene) Hulten
Draba fladnizensis Wulfen
Draba glabella Pursh
Draba nemorosa L.
Dracocephalum parviflorum Nutt.
Drosera anglica Hudson
Drosera rotundifolia L.
Dryas drummondii Richardson
Dryas octopetala L. var. *octopetala*
Dryopteris fragrans (L.) Schott

Eleocharis acicularis (L.) Roemer & Schultes
Eleocharis palustris (L.) Roemer & Schultes
Elymus alaskanus (Scribner & Merr.) A. Loeve ssp. *borealis* (Turcz.) A. Loeve & D. Loeve [= *Agropyron boreale* (Turcz.) Drobov]
Elymus macrourus (Turcz.) Tzvelev [= *Agropyron macrourum* (Turcz. Drobov)]
Elymus subsecundus (Link) A. Loeve & D. Loeve [= *Agropyron subsecundum* (Link) Hitchc.]
Elymus trachycaulus (Link) Gould ex Shinners [= *Agropyron pauciflorum* (Schwein.) Hitchc.]
Elymus trachycaulus (Link) Gould ex Shinners ssp. *trachycaulus* [= *Agropyron pauciflorum* (Schwein.) Hitchc. ssp. *novae-angliae* (Scribn) Melderis]
Elymus trachycaulus (Link) Gould ex Shinners ssp. *violaceus* (Hornem.) A. Loeve & D. Loeve
Elytrigia repens (L.) Nevski [= *Agropyron repens* (L.) Beauv.]
Elytrigia spicata (Pursh) D. R. Dewey [= *Agropyron spicatum* (Pursh) Scribn. & Sm.]
Empetrum hermaphroditum (Lange) Hagerup = [*E. nigrum* L. ssp. *hermaphroditum* (Lange) Boecher]
Epilobium angustifolium L.
Epilobium ciliatum Raf.
Epilobium ciliatum Raf. ssp. *adenocaulon* (Hausskn.) Hoch & Raven [= *E. adenocaulon* Hausskn.]
Epilobium hornemannii Reichb. ssp. *hornemannii*
Epilobium latifolium L.
Epilobium palustre L.
Equisetum arvense L.
Equisetum fluviatile L. ampl. Ehrh.
Equisetum hiemale L.
Equisetum palustre L.
Equisetum pratense Ehrh.
Equisetum scirpoides Michaux
Equisetum silvaticum L.
Equisetum variegatum Schleicher
Erigeron acris L.
Erigeron caespitosus Nutt.
Erigeron compositus Pursh
Erigeron elatus E. Greene
Erigeron glabellus Nutt.
Erigeron lonchophyllus Hook.
Eriophorum angustifolium Honck. ssp. *scabriusculum* Hulten
Eriophorum gracile Koch
Eriophorum russeolum Fries
Eriophorum scheuchzeri Hoppe
Eriophorum vaginatum L.
Erodium cicutarium (L.) L'Hér.
Erysimum cheiranthoides L. ssp. *cheiranthoides*
Erysimum inconspicuum (S. Watson) MacMillan
Eschscholzia californica Cham.
Euphrasia disjuncta Fern. & Wieg.

Festuca altaica Trin.
Festuca brachyphylla Schultes & Schultes F.
Festuca lenensis Drobov [= *F. ovina* L. ssp. *alaskensis* Holmen]
Festuca saximontana Rydb.
Fragaria virginiana Duchesne

Gaillardia pulchella Foug.
Galeopsis bifida Boenn.
Galium boreale L.
Galium brandegei A. Gray
Galium trifidum L. ssp. *trifidum*
Galium triflorum Michaux
Gastrolychnis affinis (Vahl) Tolm. & Kozhanch. [= *Melandrium affine* Vahl]
Gastrolychnis ostenfeldii (A. Pors.) V.V. Petrovsky [= *Melandrium taimyrense* Tolm.]
Gentiana glauca Pallas
Gentianella amarella (L.) Boerner [= *Gentiana amarella* L.]
Gentianella propinqua (Richardson) J.M. Gillett [= *Gentiana propinqua* Richardson]
Gentianopsis detonsa (Rottb.) Malte ssp. *yukonensis* (J.M. Gillett) J.M. Gillett [= *Gentiana barbata* Froel.]
Geocaulon lividum (Richardson) Fern.
Geranium bicknellii Britton
Geum perincisum Rydb.
Glyceria borealis (Nash) Batch.
Glyceria maxima (Hartman F.) O. Holmb.
Glyceria pulchella (Nash) Schum.
Gnaphalium uliginosum L.
Goodyera repens (L.) R. Br.
Gymnocarpium dryopteris (L.) Newman
Gymnocarpium robertianum (Hoffm.) Newman

Halimolobus mollis (Hook.) Rollins
Hammarbya paludosa (L.) Kuntze
Hedysarum alpinum L. ssp. *americanum* (Michaux) B. Fedtsch.
Hedysarum mackenzii Richardson
Hesperis matronalis L.
Hierochloë alpina (Sw.) Roemer & Schultes
Hierochloë odorata (L.) P. Beauv.
Hippuris vulgaris L.
Hordeum brachyantherum Nevski
Hordeum jubatum L.
Huperzia selago (L.) C. Martius ssp. *apressa* (Desv.) D. Love = [*Lycopodium selago* L. ssp. *appressum* (Desv.) Hulten]

Impatiens noli-tangere L.
Iris setosa Pallas

Juncus alpinus Villars
Juncus arcticus Willd. ssp. *alaskanus* Hulten
Juncus arcticus Willd. ssp. *ater* (Rydb.) Hulten
Juncus bufonius L.
Juncus castaneus Smith ssp. *castaneus*
Juncus castaneus Smith ssp. *leucochlamys* (I. Zinserl.) Hulten
Juncus filiformis L.
Juncus stygius L.
Juncus triglumis L. ssp. *albescens* (Lange) Hulten
Juniperus communis L.

Kobresia simpliciuscula (Wahlenb.) Mackenzie

Lappula myosotis Moench
Larix laricina (Du Roi) K. Koch
Ledum groenlandicum Oeder [= *L. palustre* L. ssp. *groenlandicum*(Oeder) Hulten]
Ledum palustre L. ssp. *decumbens* (Aiton) Hulten
Lemna minor L.
Lemna trisulca L.
Lepidium densiflorum Schrader
Lepidium ruderale L.
Leymus innovatus (Beal) Pilger [= *Elymus innovatus* Beal]
Linaria vulgaris Miller
Linnaea borealis L.
Linum lewisii Pursh
Listera borealis Morong
Loiseleuria procumbens (L.) Desv.
Lolium multiflorum Lam.
Lomatogonium rotatum (L.) E. Fries
Lupinus arcticus S. Watson
Luzula confusa Lindeb.
Luzula kjellmaniana Miyabe & Kudo
Luzula multiflora (Retz.) Lej.
Luzula parviflora (Ehrh.) Desv.
Luzula rufescens Fischer
Lycopodium alpinum L.
Lycopodium annotinum L. ssp. *annotinum*
Lycopodium annotinum L. ssp. *pungens* (La Pyl.) Hulten
Lycopodium complanatum L.
Lycopodium obscurum L.
Lycopus uniflorus Michaux
Lysimachia thyrsiflora L.

Matricaria matricarioides (Less.) Porter
Medicago falcata L.
Medicago sativa L.
Melilotus albus Desrr.
Melilotus officinalis (L.) Lam.
Menyanthes trifoliata L.
Mertensia paniculata (Aiton) G. Don
Minuartia arctica (Steven) Asch. & Graebner
Minuartia yukonensis Hulten
Moehringia lateriflora (L.) Fenzl
Moneses uniflora (L.) A. Gray
Myrica gale L.
Myriophyllum sibiricum Kom.
Myriophyllum verticillatum L.

Nemophila menziesii Hook. & Arn.
Nuphar polysepalum Engelm.
Nymphaea tetragona Georgi

Orthilia secunda (L.) House [= *Pyrola secunda* L.]
Orthilia secunda (L.) House ssp. *obtusata* (Turcz.) Bocher [= *Pyrola secunda* L. ssp. *obtusata* (Turcz.) Hulten]
Oxycoccus microcarpus Turcz. ex Rupr.
Oxytropis deflexa (Pallas) DC. var. *foliolosa* (Hook.) Barneby
Oxytropis deflexa (Pallas) DC. var. *sericea* Torrey & A. Gray
Oxytropis tananensis B.A. Yurtsev
Oxytropis varians (Rydb.) Schumann [= *O. campestris* (L.) D.C. ssp. *gracilis* (Nels) Hulten]

Parnassia palustris L.

Parrya nudicaulis (L.) Regel
Pedicularis capitata J. Adams
Pedicularis labradorica Wirs.
Pedicularis lanata Cham. & Schldl. [= *P. kanei* Durand]
Pedicularis langsdorffii Fischer ex Steven
Pedicularis macrodonta Richardson
Pentaphylloides floribunda (Pursh) A. Loeve [= *Potentilla fruticosa* L.]
Petasites frigidus (L.) Franchet
Petasites nivalis E. Greene [= *P. hyperboreus* Rydb.]
Petasites sagittatus (Banks) A. Gray
Phleum pratense L.
Picea glauca (Moench) Voss
Picea mariana (Miller) Britton, Sterns, Pogg.
Pinguicula villosa L.
Plagiobothrys cognatus (E. Greene) I.M. Johnston
Plantago major L. var. *major*
Platanthera hyperborea (L.) Lindley
Platanthera obtusata (Pursh) Lindley
Poa alpina L.
Poa annua L.
Poa arctica R. Br.
Poa glauca M. Vahl
Poa palustris L.
Poa pratensis L.
Podistera macounii (J. Coulter & Rose) Mathias & Constance [= *Ligusticum mutellinoides* (Crantz) Willar]
Polemonium acutiflorum Willd.
Polygonum alaskanum (Small) W. Wight
Polygonum amphibium L.
Polygonum aviculare L.
Polygonum convolvulus L.
Polygonum lapathifolium L.
Polygonum pennsylvanicum L. ssp. *Oneillii* (Brenckle) Hulten
Polypodium vulgare L. ssp. *columbianum* (Gilbert) Hulten
Populus balsamifera L. ssp. *balsamifera*
Populus tremuloides Michaux
Potamogeton alpinus Balbis
Potamogeton epihydrus Raf.
Potamogeton filiformis Pers.
Potamogeton friesii Rupr.
Potamogeton gramineus L.
Potamogeton pectinatus L. [= *P. berchtoldii* Fieb.]
Potamogeton praelongus Wulfen
Potamogeton pusillus L. var. *tenuissimus* Mert. & Koch
Potamogeton richardsonii (A. Bennett) Rydb. [= *P. perfoliatus* (L.) ssp. *richardsonii* (Bennett) Hulten]
Potamogeton vaginatus Turcz.
Potamogeton zosteriformis Fernald
Potentilla arguta Pursh
Potentilla egedii Wormsk.
Potentilla hookeriana Lehm.
Potentilla multifida L.
Potentilla norvegica L.
Potentilla pennsylvanica L.
Potentilla uniflora Ledeb.
Potentilla virgulata Nelson
Primula incana M.E. Jones
Puccinellia borealis Swallen
Puccinellia interior T. Sorensen

Pulsatilla patens (L.) Miller
Pyrola asarifolia Michaux
Pyrola chlorantha Sw.
Pyrola grandiflora Radius

Ranunculus gmelinii DC.
Ranunculus hyperboreus Rottb.
Ranunculus lapponicus L.
Ranunculus macounii Britton
Ranunculus pennsylvanicus L. F.
Ranunculus reptans L.
Ranunculus sceleratus L. ssp. *multifidus* (Nutt.) Hulten
Ranunculus trichophyllus Chaix
Rhinanthus minor L.
Ribes hudsonianum Richardson
Ribes lacustre (Pers.) Poiret
Ribes triste Pallas
Rorippa barbareaefolia (DC.) Kitigawa
Rorippa curvisiliqua (Hook.) Besser
Rorippa palustris (L.) Besser ssp. *hispida* (Desv.) Jonsell [= *R. hispida* (Desv.) Britt.]
Rorippa palustris (L.) Besser ssp. *palustris*
Rosa acicularis Lindley
Rosa woodsii Lindley
Rubeckia hirta L.
Rubus arcticus L. ssp. *arcticus*
Rubus chamaemorus L.
Rubus idaeus L.
Rumex arcticus Trautv.
Rumex fenestratus E. Greene
Rumex mexicanus Meissner
Rumex sibiricus Hulten

Sagittaria cuneata E. Sheldon
Salix alaxensis (Andersson) Cov. var. *longistylis* (Rydb.) C. Schneider
Salix arbusculoides Andersson
Salix arctica Pallas
Salix bebbiana Sarg. [= *S. depressa* L. ssp. *rostrata* (Anderss.) Hiitonen]
Salix brachycarpa Nutt.
Salix brachycarpa Nutt. ssp. *niphoclada* (Rydb.) Argus [= *S. niphoclada* Rydb. ssp. *niphoclada*]
Salix fuscescens Andersson
Salix glauca L.
Salix glauca L. var. *acutifolia* (Andersson) C. Schneider
Salix hastata L.
Salix interior Rowlee
Salix lucida Muhl. ssp. *lasiandra* (Benth.) Argus [= *S. lasiandra* Benth.]
Salix myrtillifolia Andersson
Salix novae-angliae Andersson
Salix phlebophylla Andersson
Salix planifolia Pursh
Salix planifolia Pursh ssp. *pulchra* (Cham.) Argus [= *S. pulchra* Cham.]
Salix pseudomonticola C. Ball
Salix scouleriana J. Barratt
Sanguisorba officinalis L.
Saussurea angustifolia (Willd.) DC.
Saxifraga cernua L.
Saxifraga nelsoniana D. Don [= *S. punctata* L. ssp. *pacifica* Hulten]
Saxifraga reflexa Hook.
Saxifraga tricuspidata Rottb.

Scirpus microcarpus C. Presl
Scirpus validus M. Vahl
Scutellaria galericulata L.
Selaginella sibirica (Milde) Hieron.
Senecio atropurpureus (Ledeb.) B. Fedtsch.
Senecio congestus (R. Br.) DC.
Senecio lugens Richardson
Senecio pauciflorus Pursh
Senecio tundricola Tolm. [= *S. fuscatus* (Jord & Fourr.) Hayek and *S. lindstroemii* (Ostf.) Porsild]
Senecio vulgaris L.
Shepherdia canadensis (L.) Nutt.
Silene williamsii Britton [= *S. menziesii* Hook. ssp. *williamsii*(Britt.) Hulten comb. nov.]
Sium suave Walter
Solidago canadensis L.
Solidago decumbens E. Greene
Solidago multiradiata Aiton
Sonchus arvensis L.
Sonchus asper (L.) Hill
Sorbus scopulina E. Greene
Sparganium angustifolium Michaux
Sparganium hyperboreum Laest.
Sparganium minimum (Hartman F.) Fries
Spergularia rubra (L.) J.S. Presl & C. Presl
Spiraea stevenii (C. Schneider) Rydb.
Spiranthes romanzoffiana Cham.
Stachys palustris L. ssp. *pilosa* (Nutt.) Epling
Stellaria borealis Bigelow ssp. *borealis*
Stellaria calycantha (Ledeb.) Bong.
Stellaria crassifolia Ehrh.
Stellaria laeta Richardson
Stellaria longifolia Muhlenb. ex Willd.
Stellaria longipes Goldie
Stellaria media (L.) Villars
Swida stolonifera (Michx.) Rydb. [= *Cornus stolonifera* Michx.]
Synthyris borealis Pennell

Taraxacum ceratophorum (Ledeb.) DC.
Taraxacum officinale G. Weber
Thalictrum sparsiflorum Turcz.
Thlaspi arvense L.
Tofieldia coccinea Richardson
Trichophorum alpinum (L.) Pers.
Trientalis europaea L. ssp. *arctica* (Fischer) Hulten
Trifolium hybridum L.
Trifolium pratense L.
Trifolium repens L.
Triglochin maritimum L.
Triglochin palustris L.
Tripleurospermum inodorum (L.) Schultz-Bip.
Trisetum spicatum (L.) K. Richter
Typha latifolia L.

Urtica dioica L. ssp. *gracilis* (Aiton) Selander [= *U. gracilis* Aiton]
Utricularia intermedia Hayne
Utricularia minor L.
Utricularia vulgaris L.

Vaccinium uliginosum L. ssp. *alpinum* (Bigelow) Hulten

Vaccinium vitis-idaea L.
Valeriana capitata Pallas
Veronica scutellata L.
Viburnum edule (Michaux) Raf.
Vicia angustifolia (L.) Reichard
Vicia cracca L.
Viola biflora L.
Viola epipsila Ledeb.
Viola renifolia A. Gray
Viola tricolor L.

Wilhelmsia physodes (Fischer) McNeill
Woodsia ilvensis (L.) R. Br.

Zygadenus elegans Pursh

APPENDIX D: CHECKLIST OF COLLECTED VASCULAR PLANTS ARRANGED BY FAMILY FROM FORT WAINWRIGHT MILITARY INSTALLATION, ALASKA, 1995

The nomenclature or plant names for both vascular and cryptogam species in this report are based on the University of Alaska Museum Alaska Plants database (ALABASE), which is not available to the public and is unpublished but is based on the latest taxonomic revisions of the various plant groups and the Flora of North America (FNAEC 1993). As a result of these recent revisions 50–60 of the vascular plant names provided in the checklists are different from the names of the same plants used in Hulten (1968). Where the names have changed, the Hulten name is given in brackets with an equal sign. If a name in Hulten still does not match a name in the checklist, two other authorities can be checked to determine the most recent name for that plant: Kartesz (1994) and the NRCS Plants database available over the Internet at http://plants.usda.gov. In some cases the name is new and does not have an equivalent in Hulten.

Adiantaceae
Cryptogramma stelleri (S. Gmelin) Prantl

Adoxaceae
Adoxa moschatellina L.

Alismataceae
Alisma triviale Pursh
Sagittaria cuneata E. Sheldon

Apiaceae
Cicuta bulbifera L.
Cicuta virosa L. [= *C. mackenzieana* Raup]
Cnidium cnidiifolium (Turcz.) Schischkin
Podistera macounii (J. Coulter & Rose) Mathias & Constance [= *Ligusticum mutellinoides* (Crantz) Willar]
Sium suave Walter

Apocynaceae
Apocynum androsaemifolium L.

Araceae
Calla palustris L.

Aspleniaceae
Athyrium filix-femina (L.) Roth
Cystopteris fragilis (L.) Bernh.
Dryopteris fragrans (L.) Schott
Gymnocarpium dryopteris (L.) Newman
Gymnocarpium robertianum (Hoffm.) Newman
Woodsia ilvensis (L.) R. Br.

Asteraceae
Achillea borealis Bong.
Achillea millefolium L.
Achillea sibirica Ledeb.
Antennaria friesiana (Trautv.) Ekman
Antennaria pulcherrima (Hook.) E. Greene
Antennaria rosea (D.C. Eaton) E. Greene
Anthemis cotula L.
Arnica alpina (L.) Olin ssp. *attenuata* (E. Greene) Maguire

Arnica angustifolia M. Vahl [= *A. alpina* (L.) Olin ssp. *angustifolia* (M. Vahl) Maguire]
Arnica griscomii Fern. ssp. *frigida* (C. Meyer ex Iljin) S.J. Wolf [= *A. frigida* C. Meyer ex Iljin]
Artemisia alaskana Rydb.
Artemisia arctica Less.
Artemisia frigida Willd.
Artemisia furcata M. Bieb.
Artemisia laciniata Willd.
Artemisia tilesii Ledeb. ssp. *elatior* (Torr. & A. Gray) Hulten
Aster junciformis Rydb.
Aster sibiricus L.
Bidens cernua L.
Chrysanthemum leucanthemum L.
Cirsium arvense (L.) Scop.
Conyza canadensis (L.) Cronq.
Crepis elegans Hook.
Crepis tectorum L.
Erigeron acris L.
Erigeron caespitosus Nutt.
Erigeron compositus Pursh
Erigeron elatus E. Greene
Erigeron glabellus Nutt.
Erigeron lonchophyllus Hook.
Gaillardia pulchella Foug.
Gnaphalium uliginosum L.
Matricaria matricarioides (Less.) Porter
Petasites frigidus (L.) Franchet
Petasites nivalis E. Greene [= *P. hyperboreus* Rydb.]
Petasites sagittatus (Banks) A. Gray
Rubeckia hirta L.
Saussurea angustifolia (Willd.) DC.
Senecio atropurpureus (Ledeb.) B. Fedtsch.
Senecio congestus (R. Br.) DC.
Senecio lugens Richardson
Senecio pauciflorus Pursh
Senecio tundricola Tolm. [*S. fuscatus* (Jord. & Fourr.) Hayek and *S. lindstroemii* (Ostf.) Porsild]
Senecio vulgaris L.
Solidago canadensis L.
Solidago decumbens E. Greene
Solidago multiradiata Aiton
Sonchus arvensis L.
Sonchus asper (L.) Hill
Taraxacum ceratophorum (Ledeb.) DC.
Taraxacum officinale G. Weber
Tripleurospermum inodorum (L.) Schultz-Bip.

Balsaminaceae
Impatiens noli-tangere L.

Betulaceae
Alnus tenuifolia Nutt. [= *A. incana* (L.) Moench ssp. *tenuifolia* (Nutt.) Breitung]
Alnus viridis (Vill.) Lam. & DC. ssp. *crispa* (Aiton) Turrill [= *A. crispa* (Ait.) Pursh ssp. *crispa*]
Betula glandulosa Michaux
Betula hybrids
Betula nana L.
Betula papyrifera Marshall

Boraginaceae
Lappula myosotis Moench
Mertensia paniculata (Aiton) G. Don
Plagiobothrys cognatus (E. Greene) I.M. Johnston

Brassicaceae
Arabis divaricarpa Nelson
Arabis hirsuta (L.) Scop.
Arabis holboellii Hornem.
Arabis lyrata L.
Barbarea orthoceras Ledeb.
Brassica rapa L.
Capsella bursa-pastoris (L.) Medik.
Cardamine pratensis L. ssp. *angustifolia* (Hook.) O.E. Schulz
Descurainia sophia (L.) Prantl
Descurainia sophioides (Fischer) O. Schulz
Draba fladnizensis Wulfen
Draba glabella Pursh
Draba nemorosa L.
Erysimum cheiranthoides L. ssp. *cheiranthoides*
Erysimum inconspicuum (S. Watson) Macmillan
Halimolobus mollis (Hook.) Rollins
Hesperis matronalis L.
Lepidium densiflorum Schrader
Lepidium ruderale L.
Parrya nudicaulis (L.) Regel
Rorippa barbareaefolia (DC.) Kitigawa
Rorippa curvisiliqua (Hook.) Besser
Rorippa palustris (L.) Besser ssp. *hispida* (Desv.) Jonsell [= *R. hispida* (Desv.) Britt.]
Rorippa palustris (L.) Besser ssp. *palustris*
Thlaspi arvense L.

Callitrichaceae
Callitriche verna L. emend. Kutz.

Campanulaceae
Campanula lasiocarpa Cham.
Campanula uniflora L.

Caprifoliaceae
Linnaea borealis L.
Viburnum edule (Michaux) Raf.

Caryophyllaceae
Dianthus barbatus L.
Gastrolychnis affinis (Vahl) Tolm. & Kozhanch. [= *Melandrium affine* Vahl]
Gastrolychnis ostenfeldii (A. Pors.) V.V. Petrovsky [= *Melandrium taimyrense* Tolm.]
Minuartia arctica (Steven) Asch. & Graebner
Minuartia yukonensis Hulten
Moehringia lateriflora (L.) Fenzl
Silene williamsii Britton [= *S. menziesii* Hook. ssp. *williamsii*(Britt.) Hulten comb. nov.]
Spergularia rubra (L.) J.S. Presl & C. Presl
Stellaria borealis Bigelow ssp. *borealis*
Stellaria calycantha (Ledeb.) Bong.
Stellaria crassifolia Ehrh.
Stellaria laeta Richardson
Stellaria longifolia Muhlenb. ex Willd.
Stellaria longipes Goldie

Stellaria media (L.) Villars
Wilhelmsia physodes (Fischer) McNeill

Ceratophyllaceae
Ceratophyllum demersum L.

Chenopodiaceae
Chenopodium album L.
Chenopodium capitatum (L.) Asch.
Chenopodium hybridum L.

Cornaceae
Cornus canadensis L.
Cornus canadensis × Suecica L.
Swida stolonifera (Michx.) Rydb. [= *Cornus stolonifera* Michx.]

Cupressaceae
Juniperus communis L.

Cyperaceae
Carex aenea Fern.
Carex aquatilis Wahlenb.
Carex atherodes Sprengel
Carex bigelowii Torrey
Carex bonanzensis Britton
Carex brunnescens (Pers.) Poiret
Carex canescens L.
Carex capillaris L.
Carex capitata Sol.
Carex chordorrhiza Ehrh.
Carex concinna R. Br.
Carex crawfordii Fern.
Carex diandra Schrank
Carex disperma Dewey
Carex duriuscula C.A. Mey. [= *Carex stenophylla* Wahlenb. ssp. *eleocharis* (L. Bailey) Hulten]
Carex eleusinoides Turcz.
Carex filifolia Nutt.
Carex garberi Fern. ssp. *bifaria* (Fern.) Hulten
Carex krausei Boeckeler
Carex lasiocarpa Ehrh.
Carex leptalea Wahlenb.
Carex limosa L.
Carex magellanica Lam. ssp. *irrigua* (Wahlenb.) Hulten
Carex maritima Gunnerus
Carex media R. Br.
Carex microchaeta Holm ssp. *microchaeta*
Carex microchaeta Holm ssp. *nesophila* (Holm) D. Murray
Carex obtusata Lilj.
Carex oederi Retz.
Carex peckii Howe
Carex phyllomanica W. Boott
Carex podocarpa R. Br.
Carex rossii Boott
Carex rostrata Stokes
Carex rotundata Wahlenb.
Carex rupestris All.
Carex saxatilis L.
Carex supina Willd. ssp. *spaniocarpa* (Steudel) Hulten
Carex tenuiflora Wahlenb.

Carex utriculata F. Boott
Carex vaginata Tausch
Eleocharis acicularis (L.) Roemer & Schultes
Eleocharis palustris (L.) Roemer & Schultes
Eriophorum angustifolium Honck. ssp. *scabriusculum* Hulten
Eriophorum gracile Koch
Eriophorum russeolum Fries
Eriophorum scheuchzeri Hoppe
Eriophorum vaginatum L.
Kobresia simpliciuscula (Wahlenb.) Mackenzie
Scirpus microcarpus C. Presl
Scirpus validus M. Vahl
Trichophorum alpinum (L.) Pers.

Diapensiaceae
Diapensia lapponica L. ssp. *obovata* (F. Schmidt) Hulten

Droseraceae
Drosera anglica Hudson
Drosera rotundifolia L.

Elaeagnaceae
Shepherdia canadensis (L.) Nutt.

Empetraceae
Empetrum hermaphroditum (Lange) Hagerup = [*E. nigrum* L. ssp. *hermaphroditum* (Lange) Boecher]

Equisetaceae
Equisetum arvense L.
Equisetum fluviatile L. ampl. Ehrh.
Equisetum hiemale L.
Equisetum palustre L.
Equisetum pratense Ehrh.
Equisetum scirpoides Michaux
Equisetum silvaticum L.
Equisetum variegatum Schleicher

Ericaceae
Andromeda polifolia L.
Arctostaphylos uva-ursi (L.) Sprengel
Arctous alpina (L.) Niedenzu [= *Arctostaphylos alpina* (L.) Spreng.]
Arctous rubra (Rehder & E. Wilson) Nakai [= *Arctostaphylos rubra* (Rehder & E. Wilson) Fern.]
Cassiope tetragona (L.) D. Don ssp. *tetragona*
Chamaedaphne calyculata (L.) Moench
Ledum groenlandicum Oeder [= *L. palustre* L. ssp. *groenlandicum*(Oeder) Hulten]
Ledum palustre L. ssp. *decumbens* (Aiton) Hulten
Loiseleuria procumbens (L.) Desv.
Oxycoccus microcarpus Turcz. ex Rupr.
Vaccinium uliginosum L. ssp. *alpinum* (Bigelow) Hulten
Vaccinium vitis-idaea L.

Fabaceae
Astragalus adsurgens Pallas ssp. *viciifolius* (Hulten) Welsh
Astragalus alpinus L.
Astragalus bodinii E. Sheldon
Caragana arborescens Lam.
Hedysarum alpinum L. ssp. *americanum* (Michaux) B. Fedtsch.

Hedysarum mackenzii Richardson
Lupinus arcticus S. Watson
Medicago falcata L.
Medicago sativa L.
Melilotus albus Desrr.
Melilotus officinalis (L.) Lam.
Oxytropis deflexa (Pallas) DC. var. *foliolosa* (Hook.) Barneby
Oxytropis deflexa (Pallas) DC. var. *sericea* Torrey & A. Gray
Oxytropis tananensis B.A. Yurtsev
Oxytropis varians (Rydb.) Schumann [= *O. campestris* (L.) D.C. ssp. *gracilis* (Nels) Hulten]
Trifolium hybridum L.
Trifolium pratense L.
Trifolium repens L.
Vicia angustifolia (L.) Reichard
Vicia cracca L.

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

Gentianaceae
Gentiana glauca Pallas
Gentianella amarella (L.) Boerner [= *Gentiana amarella* L.]
Gentianella propinqua (Richardson) J.M. Gillett [= *Gentiana propinqua* Richardson]
Gentianopsis detonsa (Rottb.) Malte ssp. *yukonensis* (J.M. Gillett) J.M. Gillett [= *Gentiana barbata* Froel.]
Lomatogonium rotatum (L.) E. Fries
Menyanthes trifoliata L.

Geraniaceae
Erodium cicutarium (L.) L'Her.
Geranium bicknellii Britton

Grossulariaceae
Ribes hudsonianum Richardson
Ribes lacustre (Pers.) Poiret
Ribes triste Pallas

Haloragaceae
Hippuris vulgaris L.
Myriophyllum sibiricum Kom.
Myriophyllum verticillatum L.

Hydrophyllaceae
Nemophila menziesii Hook. & Arn.

Iridaceae
Iris setosa Pallas

Juncaceae
Juncus alpinus Villars
Juncus arcticus Willd. ssp. *alaskanus* Hulten
Juncus arcticus Willd. ssp. *ater* (Rydb.) Hulten
Juncus bufonius L.
Juncus castaneus Smith ssp. *castaneus*
Juncus castaneus Smith ssp. *leucochlamys* (I. Zinserl.) Hulten
Juncus filiformis L.
Juncus stygius L.
Juncus triglumis L. ssp. *albescens* (Lange) Hulten

Luzula confusa Lindeb.
Luzula kjellmaniana Miyabe & Kudo
Luzula multiflora (Retz.) Lej.
Luzula parviflora (Ehrh.) Desv.
Luzula rufescens Fischer

Juncaginaceae
Triglochin maritimum L.
Triglochin palustris L.

Lamiaceae
Dracocephalum parviflorum Nutt.
Galeopsis bifida Boenn.
Lycopus uniflorus Michaux
Scutellaria galericulata L.
Stachys palustris L. ssp. *pilosa* (Nutt.) Epling

Lemnaceae
Lemna minor L.
Lemna trisulca L.

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

Liliaceae
Tofieldia coccinea Richardson
Zygadenus elegans Pursh

Linaceae
Linum lewisii Pursh

Lycopodiaceae
Huperzia selago (L.) C. Martius ssp. *apressa* (Desv.) D. Love = [*Lycopodium selago* L. ssp. *appressum* (Desv.) Hulten]
Lycopodium alpinum L.
Lycopodium annotinum L. ssp. *annotinum*
Lycopodium annotinum L. ssp. *pungens* (La Pyl.) Hulten
Lycopodium complanatum L.
Lycopodium obscurum L.

Myricaceae
Myrica gale L.

Nymphaeaceae
Nuphar polysepalum Engelm.
Nymphaea tetragona Georgi

Onagraceae
Circaea alpina L.
Epilobium angustifolium L.
Epilobium ciliatum Raf.
Epilobium ciliatum Raf. ssp. *adenocaulon* (Hausskn.) Hoch & Raven [= *E. adenocaulon* Hausskn.]
Epilobium hornemannii Reichb. ssp. *Hornemannii*
Epilobium latifolium L.
Epilobium palustre L.

Ophioglossaceae
Botrychium lunaria (L.) Sw.

Orchidaceae
Calypso bulbosa (L.) Oakes
Corallorrhiza trifida Chatel.
Cypripedium guttatum Sw. ssp. *guttatum*
Cypripedium passerinum Richardson
Goodyera repens (L.) R. Br.
Hammarbya paludosa (L.) Kuntze
Listera borealis Morong
Platanthera hyperborea (L.) Lindley
Platanthera obtusata (Pursh) Lindley
Spiranthes romanzoffiana Cham.

Orobanchaceae
Boschniakia rossica (Cham. & Schlecht.) B. Fedtsch.

Papaveraceae
Eschscholzia californica Cham.

Pinaceae
Larix laricina (Du Roi) K. Koch
Picea glauca (Moench) Voss
Picea mariana (Miller) Britton, Sterns, Pogg.

Plantaginaceae
Plantago major L. var. *major*

Poaceae
Agrostis scabra Willd.
Alopecurus aequalis Sobol.
Alopecurus alpinus Smith
Alopecurus pratensis L.
Arctagrostis latifolia (R. Br.) Griseb. var. *arundinacea* (Trin.) Griseb.
Arctophila fulva (Trin.) Andersson
Avena fatua L.
Beckmannia erucaeformis (L.) Host
Bromopsis inermis (Leysser) Holub [= *Bromus inermis* Leysser]
Bromopsis pumpelliana (Scribner) Holub ssp. *pumpelliana* [= *Bromus pumpellianus* Scrib. var. *pupellianus*]
Calamagrostis canadensis (Michaux) P. Beauv.
Calamagrostis inexpansa A. Gray
Calamagrostis lapponica (Wahlenb.) Hartman F.
Calamagrostis neglecta (Ehrh.) Gaertner
Calamagrostis purpurascens R. Br.
Deschampsia cespitosa (L.) P. Beauv.
Elymus alaskanus (Scribner & Merr.) A. Loeve ssp. *borealis* (Turcz.) A. Loeve & D. Loeve [= *Agropyron boreale* (Turcz.) Drobov]
Elymus macrourus (Turcz.) Tzvelev [= *Agropyron macrourum* (Turcz. Drobov)]
Elymus subsecundus (Link) A. Loeve & D. Loeve [= *Agropyron subsecundum* (Link) Hitchc.]
Elymus trachycaulus (Link) Gould ex Shinners [=*Agropyron pauciflorum* (Schwein.) Hitchc.]
Elymus trachycaulus (Link) Gould ex Shinners ssp. *trachycaulus* [= *Agropyron pauciflorum* (Schwein.) Hitchc. ssp. *novae-angliae* (Scribn) Melderis]
Elymus trachycaulus (Link) Gould ex Shinners ssp. *violaceus* (Hornem.) A. Loeve & D. Loeve
Elytrigia repens (L.) Nevski [= *Agropyron repens* (L.) Beauv.]
Elytrigia spicata (Pursh) D. R. Dewey [= *Agropyron spicatum* (Pursh) Scribn. & Sm.]

Festuca altaica Trin.
Festuca brachyphylla Schultes & Schultes F.
Festuca lenensis Drobov [= *F. ovina* L. ssp. *alaskensis* Holmen]
Festuca saximontana Rydb.
Glyceria borealis (Nash) Batch.
Glyceria maxima (Hartman F.) O. Holmb.
Glyceria pulchella (Nash) Schum.
Hierochloe alpina (Sw.) Roemer & Schultes
Hierochloe odorata (L.) P. Beauv.
Hordeum brachyantherum Nevski
Hordeum jubatum L.
Leymus innovatus (Beal) Pilger [= *Elymus innovatus* Beal]
Lolium multiflorum Lam.
Phleum pratense L.
Poa alpina L.
Poa annua L.
Poa arctica R. Br.
Poa glauca M. Vahl
Poa palustris L.
Poa pratensis L.
Puccinellia borealis Swallen
Puccinellia interior T. Sorensen
Trisetum spicatum (L.) K. Richter

Polemoniaceae
Collomia linearis Nutt.
Polemonium acutiflorum Willd.

Polygonaceae
Bistorta plumosa (Small) E. Greene [= *Polygonum bistorta* L. ssp. *plumosum* (Small) Hulten]
Bistorta vivipara (L.) Gray [= *Polygonum viviparum* L.]
Polygonum alaskanum (Small) W. Wight
Polygonum amphibium L.
Polygonum aviculare L.
Polygonum convolvulus L.
Polygonum lapathifolium L.
Polygonum pennsylvanicum L. ssp. *Oneillii* (Brenckle) Hulten
Rumex arcticus Trautv.
Rumex fenestratus E. Greene
Rumex mexicanus Meissner
Rumex sibiricus Hulten

Polypodiaceae
Polypodium vulgare L. ssp. *columbianum* (Gilbert) Hulten

Potamogetonaceae
Potamogeton alpinus Balbis
Potamogeton epihydrus Raf.
Potamogeton filiformis Pers.
Potamogeton friesii Rupr.
Potamogeton gramineus L.
Potamogeton pectinatus L. [= *P. berchtoldii* Fieb.]
Potamogeton praelongus Wulfen
Potamogeton pusillus L. var. *tenuissimus* Mert. & Koch
Potamogeton richardsonii (A. Bennett) Rydb. [= *P. perfoliatus* (L.) ssp. *richardsonii* (Bennett) Hulten]
Potamogeton vaginatus Turcz.
Potamogeton zosteriformis Fernald

Primulaceae
Androsace septentrionalis L.
Dodecatheon pulchellum (Raf.) Merr. ssp. *pauciflorum* (E. Greene) Hulten
Lysimachia thyrsiflora L.
Primula incana M.E. Jones
Trientalis europaea L. ssp. *arctica* (Fischer) Hulten

Pyrolaceae
Moneses uniflora (L.) A. Gray
Orthilia secunda (L.) House [= *Pyrola secunda* L.]
Orthilia secunda (L.) House ssp. *obtusata* (Turcz.) Bocher [= *Pyrola secunda* L. ssp. *obtusata* (Turcz.) Hulten]
Pyrola asarifolia Michaux
Pyrola chlorantha Sw.
Pyrola grandiflora Radius

Ranunculaceae
Aconitum delphinifolium DC.
Actaea rubra (Aiton) Willd.
Anemone narcissiflora L. var. *monantha* DC.
Anemone parviflora Michaux
Anemone richardsonii Hook.
Aquilegia brevistyla Hook.
Caltha natans Pallas
Caltha palustris L.
Consolida ambiqua (L.) P. Bass & Heyw.
Delphinium glaucum S. Watson
Pulsatilla patens (L.) Miller
Ranunculus gmelinii DC.
Ranunculus hyperboreus Rottb.
Ranunculus lapponicus L.
Ranunculus macounii Britton
Ranunculus pennsylvanicus L. F.
Ranunculus reptans L.
Ranunculus sceleratus L. ssp. *multifidus* (Nutt.) Hulten
Ranunculus trichophyllus Chaix
Thalictrum sparsiflorum Turcz.

Rosaceae
Amelanchier alnifolia (Nutt.) Nutt.
Comarum palustre L. [= *Potentilla palustris* (L.) Scop.]
Dryas drummondii Richardson
Dryas octopetala L. var. *octopetala*
Fragaria virginiana Duchesne
Geum perincisum Rydb.
Pentaphylloides floribunda (Pursh) A. Loeve [= *Potentilla fruticosa* L.]
Potentilla arguta Pursh
Potentilla egedii Wormsk.
Potentilla hookeriana Lehm.
Potentilla multifida L.
Potentilla norvegica L.
Potentilla pennsylvanica L.
Potentilla uniflora Ledeb.
Potentilla virgulata Nelson
Rosa acicularis Lindley
Rosa woodsii Lindley
Rubus arcticus L. ssp. *arcticus*
Rubus chamaemorus L.

Rubus idaeus L.
Sanguisorba officinalis L.
Sorbus scopulina E. Greene
Spiraea Stevenii (C. Schneider) Rydb.

Rubiaceae
Galium boreale L.
Galium brandegei A. Gray
Galium trifidum L. ssp. *trifidum*
Galium triflorum Michaux

Salicaceae
Populus balsamifera L. ssp. *balsamifera*
Populus tremuloides Michaux
Salix alaxensis (Andersson) Cov. var. *longistylis* (Rydb.) C. Schneider
Salix arbusculoides Andersson
Salix arctica Pallas
Salix bebbiana Sarg. [= *S. depressa* L. ssp. *rostrata* (Anderss.) Hiitonen]
Salix brachycarpa Nutt.
Salix brachycarpa Nutt. ssp. *niphoclada* (Rydb.) Argus [= *S. niphoclada* Rydb. ssp. *niphoclada*]
Salix fuscescens Andersson
Salix glauca L.
Salix glauca L. var. *acutifolia* (Andersson) C. Schneider
Salix hastata L.
Salix interior Rowlee
Salix lucida Muhl. ssp. *lasiandra* (Benth.) Argus [= *S. lasiandra* Benth.]
Salix myrtillifolia Andersson
Salix novae-angliae Andersson
Salix phlebophylla Andersson
Salix planifolia Pursh
Salix planifolia Pursh ssp. *pulchra* (Cham.) Argus [= *S. pulchra* Cham.]
Salix pseudomonticola C. Ball
Salix scouleriana J. Barratt

Santalaceae
Geocaulon lividum (Richardson) Fern.

Saxifragaceae
Chrysosplenium tetrandrum (N. Lund) T.C.E. Fries
Parnassia palustris L.
Saxifraga cernua L.
Saxifraga nelsoniana D. Don [= *S. punctata* L. ssp. *pacifica* Hulten]
Saxifraga reflexa Hook.
Saxifraga tricuspidata Rottb.

Scrophulariaceae
Castilleja caudata (Pennell) Rebrist.
Castilleja elegans Malte
Euphrasia disjuncta Fern. & Wieg.
Linaria vulgaris Miller
Pedicularis capitata J. Adams
Pedicularis labradorica Wirs.
Pedicularis lanata Cham. & Schldl. [= *P. kanei* Durand]
Pedicularis langsdorffii Fischer ex Steven
Pedicularis macrodonta Richardson
Rhinanthus minor L.
Synthyris borealis Pennell
Veronica scutellata L.

Selaginellaceae
Selaginella sibirica (Milde) Hieron.

Sparganiaceae
Sparganium angustifolium Michaux
Sparganium hyperboreum Laest.
Sparganium minimum (Hartman F.) Fries

Typhaceae
Typha latifolia L.

Urticaceae
Urtica dioica L. ssp. *gracilis* (Aiton) Selander [= *U. gracilis* Aiton]

Valerianaceae
Valeriana capitata Pallas

Violaceae
Viola biflora L.
Viola epipsila Ledeb.
Viola renifolia A. Gray
Viola tricolor L.

APPENDIX E: ALPHABETICAL CHECKLIST OF IDENTIFIED COMMON GROUNDCOVER CRYPTOGAMS COLLECTED ON FT. WAINWRIGHT, ALASKA, 1995

Genus names represent specimens identified to genus but not yet identified to species. * refers to a lichenicolous fungus.

Lichens

Alectoria ochroleuca (Hoffm.) A. Massal.
Anamylopsora pulcherrima (Vain.) Timdal
Arctoparmelia separata (Th.Fr.) Hale
Asahinea chrysantha (Tuck.) W.L. Culb. & C.F. Culb.
Asahinea scholanderi (Llano) W.L. Culb. & C.F. Culb.
Baeomyces rufus (Huds.) Rebent.
Brodoa oroarctica (Krog) Goward
Bryocaulon divergens (Ach.) Kärnefelt
Bryoria lanestris (Ach.) Brodo & D. Hawksw.
Bryoria nitidula (Th.Fr.) Brodo & D. Hawksw.
Cetraria aculeata (Schreb.) Fr.
Cetraria islandica (L.) Ach.
Cetraria laevigata Rass.
Cetraria muricata (Ach.) Eckfeldt
Cetraria nigricans Nyl.
Chaenotheca stemonea (Ach.) Müll. Arg.
Cladina aberrans (Abbayes) Hale & W.L. Culb.
Cladina arbuscula (Wallr.) Hale & W.L. Culb.
Cladina rangiferina (L.) Nyl.
Cladina stellaris (Opiz) Brodo
Cladonia amaurocraea (Flörke) Schaer.
Cladonia borealis S.Stenroos
Cladonia cariosa (Ach.) Spreng.
Cladonia cenotea (Ach.) Schaer.
Cladonia coccifera (L.) Willd.
Cladonia cornuta (L.) Hoffm.
Cladonia cornuta (L.) Hoffm. ssp. *cornuta*
Cladonia crispata (Ach.) Flot.
Cladonia deformis (L.) Hoffm.
Cladonia fimbriata (L.) Fr.
Cladonia furcata (Huds.) Schrad.
Cladonia gracilis (L.) Willd.
Cladonia gracilis (L.) Willd. ssp. *gracilis*
Cladonia gracilis (L.) Willd. ssp. *turbinata* (Ach.) Ahti
Cladonia kanewskii Oksner
Cladonia phyllophora Ehrh. ex Hoffm.
Cladonia pleurota (Flörke) Schaer.
Cladonia pocillum (Ach.) Grognot
Cladonia scabriuscula (Delise) Nyl.
Cladonia singularis S.Hammer
Cladonia uncialis (L.) Weber ex F.H. Wigg.
Dactylina arctica (Richardson) Nyl.
Dibaeis baeomyces (L.f.) Rambold & Hertel
*Epilichen scabrosus** (Ach.) Clem. ex Hafellner
Flavocetraria cucullata (Bellardi) Kärnefelt & Thell
Flavocetraria nivalis (L.) Kärnefelt & Thell ssp. *nivalis*
Hypogymnia
Hypogymnia austerodes (Nyl.) Räsänen
Hypogymnia physodes (L.) Nyl.
Hypogymnia subobscura (Vain.) Poelt

Icmadophila ericetorum (L.) Zahlbr.
Lasallia pennsylvanica (Hoffm.) Llano
Lobaria linita (Ach.) Rabenh.
Lobaria linita (Ach.) Rabenh. var. *linita*
Lobaria scrobiculata (Scop.) DC. in Lam. & DC.
Lopadium pezizoideum (Ach.) Körb.
Masonhalea richardsonii (Hook.) Kärnefelt
Melanelia granulosa (Lynge) Essl.
Melanelia hepatizon (Ach.) Thell
Nephroma arcticum (L.) Torss.
Nephroma bellum (Spreng.) Tuck.
Nephroma expallidum (Nyl.) Nyl.
Nephroma parile (Ach.) Ach.
Nephroma resupinatum (L.) Ach.
Ochrolechia upsaliensis (L.) A. Massal.
Ophioparma lapponica (Räsänen) Hafellner & R.W. Rogers
Pannaria pezizoides (Weber) Trevis.
Parmelia fraudans (Nyl.) Nyl.
Parmelia omphalodes (L.) Ach.
Parmelia panniformis (Nyl.) Vain.
Parmelia saxatilis (L.) Ach.
Parmelia sulcata Taylor
Peltigera aphthosa (L.) Willd.
Peltigera canina (L.) Willd.
Peltigera collina (Ach.) Schrad.
Peltigera didactyla (With.) J.R. Laundon
Peltigera didactyla (With.) J.R. Laundon var. *didactyla*
Peltigera didactyla (With.) J.R. Laundon var. *extenuata* (Nyl. ex Vain.) Goffinet & Hastings
Peltigera elisabethae Gyeln.
Peltigera lepidophora (Nyl. ex Vain.) Bitter
Peltigera leucophlebia (Nyl.) Gyeln.
Peltigera malacea (Ach.) Funck
Peltigera polydactyla aggregate
Peltigera praetextata (Flörke ex Sommerf.) Zopf
Peltigera retifoveata Vitik.
Peltigera rufescens (Weiss) Humb.
Peltigera scabrosa Th. Fr.
Peltigera venosa (L.) Hoffm.
Pertusaria subobducens Nyl.
Phaeophyscia
Phaeophyscia constipata (Norrl. & Nyl.) Moberg
Phaeophyscia kairamoi (Vain.) Moberg
Phaeophyscia sciastra (Ach.) Moberg
Phaeorrhiza nimbosa (Fr.) H. Mayrhofer & Poelt
Physconia isidiigera (Zahlbr.) Essl.
Physconia muscigena (Ach.) Poelt
Physconia perisidiosa (Erichsen) Moberg
Polychidium muscicola (Sw.) Gray
Psoroma hypnorum (Vahl) Gray
Psorula rufonigra (Tuck.) Gotth.Schneid.
Rhizoplaca chrysoleuca (Sm.) Zopf
Schadonia fecunda (Th.Fr.) Vezda & Poelt
Solorina crocea (L.) Ach.
Sphaerophorus fragilis (L.) Pers.
Sphaerophorus globosus (Huds.) Vain.
Sphaerophorus globosus (Huds.) Vain. var. *globosus*
Stereocaulon alpinum Laurer ex Funck
Stereocaulon coniophyllum I.M. Lamb
Stereocaulon glareosum (Savicz) H. Magn.

Stereocaulon paschale (L.) Hoffm.
Stereocaulon subcoralloides (Nyl.) Nyl.
Thamnolia vermicularis (Sw.) Ach. ex Schaer.
Tuckermannopsis americana (Spreng.) Hale
Umbilicaria deusta (L.) Baumg.
Umbilicaria vellea (L.) Ach.
Vulpicida pinastri (Scop.) Mattson & M.J. Lai
Vulpicida tilesii (Ach.) Mattson & M.J. Lai

Hepatics

Aneura pinguis (L.) Dumort.
Asterella saccata (Wahlenb.) A. Evans
Blepharostoma trichophyllum (L.) Dumort.
Conocephalum conicum (L.) Underw.
Marchantia aquatica (Nees) Burgeff
Marchantia polymorpha L.
Preissia quadrata (Scop.) Nees
Ptilidium ciliare (L.) Hampe
Riccia fluitans L.
Ricciocarpos natans (L.) Corda
Tetralophozia setiformis (Ehrh.) Schljakov

Mosses

Abietinella abietina (Hedw.) M.Fleisch.
Aloina brevirostris (Hook. & Grev.) Kindb.
Andreaea rupestris Hedw.
Andreaea rupestris Hedw. var. *rupestris*
Aongstroemia longipes (Sommerf.) Bruch & Schimp. in Bruch, Schimp. & W. Gümbel
Aulacomnium palustre (Hedw.) Schwägr.
Aulacomnium turgidum (Wahlenb.) Schwägr.
Bartramia ithyphylla Brid.
Bryoerythrophyllum recurvirostrum (Hedw.) P.C. Chen
Bryum argenteum Hedw.
Bryum pseudotriquetrum (Hedw.) P. Gaertn., B. Mey. & Scherb.
Calliergon cordifolium (Hedw.) Kindb.
Calliergon giganteum (Schimp.) Kindb.
Calliergon richardsonii (Mitt.) Kindb.
Calliergon stramineum (Brid.) Kindb.
Catoscopium nigritum (Hedw.) Brid.
Ceratodon purpureus (Hedw.) Brid.
Ceratodon purpureus (Hedw.) Brid. var. *purpureus*
Climacium dendroides (Hedw.) F.Weber & D. Mohr
Conostomum tetragonum (Hedw.) Lindb.
Dicranoweisia crispula (Hedw.) Lindb. ex Milde
Dicranum polysetum Sw.
Dicranum undulatum Brid.
Distichium capillaceum (Hedw.) Bruch & Schimp.
Drepanocladus exannulatus (Schimp. in Bruch, Schimp. & W. Gümbel) Warnst.
Encalypta brevicolla (Bruch & Schimp. in Bruch, Schimp. & W. Gümbel) Bruch ex Ångstr.
Encalypta ciliata Hedw.
Encalypta rhaptocarpa Schwägr.
Funaria hygrometrica Hedw.
Grimmia torquata Hornsch. in Grev.
Hamatocaulis vernicosus (Mitt.) Hedenäs
Hedwigia ciliata (Hedw.) P. Beauv.

Helodium blandowii (F. Weber & D. Mohr) Warnst.
Hylocomium splendens (Hedw.) Schimp. in Bruch, Schimp. & W. Gümbel
Leptobryum pyriforme (Hedw.) Wilson
Meesia uliginosa Hedw.
Oncophorus virens (Hedw.) Brid.
Orthotrichum obtusifolium Brid.
Plagiomnium cuspidatum (Hedw.) T. Kop.
Plagiomnium rugicum (Laurer) T. Kop.
Pleurozium schreberi (Brid.) Mitt.
Pogonatum dentatum (Brid.) Brid.
Pohlia andalusica (Hoehnel) Broth.
Pohlia cruda (Hedw.) Lindb.
Pohlia proligera (Lindb. ex Breidl.) Lindb. ex Arnell
Polytrichastrum longisetum (Brid.) G.L. Sm.
Polytrichum commune Hedw.
Polytrichum hyperboreum R. Br.
Polytrichum juniperinum Hedw.
Polytrichum piliferum Hedw.
Polytrichum strictum Brid.
Pseudobryum cinclidioides (Huebener) T. Kop.
Psilopilum cavifolium (Wilson) I. Hagen
Pterygoneurum subsessile (Brid.) Jur.
Ptilium crista-castrensis (Hedw.) De Not.
Pylaisiella polyantha (Hedw.) Grout
Racomitrium ericoides (F.Weber ex Brid.) Brid.
Racomitrium lanuginosum (Hedw.) Brid.
Rhizomnium punctatum (Hedw.) T. Kop.
Rhytidiadelphus triquetrus (Hedw.) Warnst.
Rhytidium rugosum (Hedw.) Kindb.
Sanionia uncinata (Hedw.) Loeske
Schistidium apocarpum (Hedw.) Bruch & Schimp. in Bruch, Schimp. & W. Gümbel
Scorpidium cossonii (Schimp.) Hedenäs
Scorpidium scorpioides (Hedw.) Limpr.
Sphagnum angustifolium (C.E.O. Jensen ex Russow) C.E.O. Jensen in Tolf
Sphagnum fimbriatum Wilson in Wilson & Hook.f. in Hook.f.
Sphagnum fuscum (Schimp.) H.Klinggr.
Sphagnum girgensohnii Russow
Sphagnum lindbergii Schimp. in Lindb.
Sphagnum magellanicum Brid.
Sphagnum platyphyllum (Lindb. ex Braithw.) Sull. ex Warnst.
Sphagnum riparium Ångstr.
Sphagnum rubellum Wilson
Sphagnum russowii Warnst.
Sphagnum squarrosum Crome
Sphagnum teres (Schimp.) Ångstr.
Sphagnum warnstorfii Russow
Splachnum ampullaceum
Splachnum luteum Hedw.
Splachnum melanocaulon (Wahlenb.) Schwägr.
Splachnum rubrum Hedw.
Splachnum sphaericum Hedw.
Syntrichia ruralis (Hedw.) F. Weber & D. Mohr
Tetraplodon mnioides (Hedw.) Bruch & Schimp. in Bruch, Schimp. & W. Gümbel
Thuidium recognitum (Hedw.) Lindb.
Timmia austriaca Hedw.
Timmia megapolitana Hedw.
Tomentypnum nitens (Hedw.) Loeske
Tortella fragilis (Drumm.) Limpr.
Tortula acaulon (L. ex With.) R.H. Zander
Tortula mucronifolia Schwägr.

APPENDIX F: GROUND COVER CRYPTOGAM–HABITAT RELATIONSHIPS

Species lists for various habitats on Ft. Wainwright, interior Alaska, generally listed in order of importance.

Table F1. Typical ground-inhabiting cryptogam species on disturbed sites in interior Alaska.

Lichens	Mosses
Baeomyces rufus	*Ceratodon purpureus*
Chaenotheca stemonea	*Aongstroemia longipes*
Cladonia cariosa	*Aulacomnium palustre*
Cladonia coccifera	*Distichium capillaceum*
Cladonia cornuta ssp. *cornuta*	*Polytrichastrum longisetum*
Cladonia fimbriata	*Psilopilum cavifolium*
Cladonia gracilis ssp. *turbinata*	*Aloina brevirostris*
Dibaeis baeomyces	*Bryum argenteum*
Pannaria pezizoides	*Catoscopium nigritum*
Peltigera didactyla var. *didactyla*	*Ceratodon purpureus* var. *purpureus*
Peltigera lepidophora	*Encalypta rhaptocarpa*
Peltigera rufescens	*Funaria hygrometrica*
Peltigera venosa	*Leptobryum pyriforme*
Psoroma hypnorum	*Pogonatum dentatum*
Stereocaulon coniophyllum	*Pohlia andalusica*
	Pohlia proligera
	Polytrichum piliferum
	Racomitrium ericoides
	Sanionia uncinata
	Splachnum luteum
	Splachnum melanocaulon
	Splachnum sphaericum
	Timmia megapolitana
	Tortula mucronifolia

Table F2. Typical ground-inhabiting cryptogams of forests in interior Alaska.

Lichens	Mosses
Peltigera canina	*Hylocomium splendens*
Peltigera leucophlebia	*Pleurozium schreberi*
Peltigera aphthosa	*Sanionia uncinata*
Peltigera elisabethae	*Aulacomnium palustre*
Cladonia gracilis ssp. *turbinata*	*Dicranum undulatum*
Peltigera malacea	*Sphagnum squarrosum*
Peltigera retifoveata	*Tomentypnum nitens*
Peltigera rufescens	*Polytrichum juniperinum*
Cladina arbuscula	*Rhytidium rugosum*
Peltigera neckeri	*Helodium blandowii*
Peltigera scabrosa	*Rhytidiadelphus triquetrus*
Cladonia amaurocraea	*Thuidium recognitum*
Nephroma expallidum	*Polytrichum strictum*
Stereocaulon paschale	*Ceratodon purpureus*
Cetraria islandica	*Climacium dendroides*
Cladina rangiferina	*Abietinella abietina*
Cladonia crispata	*Calliergon stramineum*
Nephroma arcticum	*Polytrichum commune*
Peltigera lepidophora	*Ptilium crista-castrensis*
Peltigera venosa	*Polytrichastrum longisetum*
Cladonia cornuta ssp. *cornuta*	*Splachnum luteum*
Cladonia fimbriata	*Splachnum sphaericum*
Cladonia cornuta	*Calliergon cordifolium*
Cladonia deformis	*Dicranum polysetum*
Cladonia furcata	*Hamatocaulis vernicosus*
Cladonia phyllophora	*Pylaisiella polyantha*
Cladonia pocillum	*Sphagnum girgensohnii*
Nephroma parile	*Sphagnum teres*
Peltigera praetextata	*Splachnum ampullaceum*
Polychidium muscicola	*Splachnum rubrum*
Stereocaulon alpinum	
Vulpicida pinastri	

Table F3. Typical cryptogam species associated with peatlands (bogs and fens) on FWA.

Lichens	Mosses
Peltigera leucophlebia	*Sphagnum girgensohnii*
Peltigera aphthosa	*Aulacomnium palustre*
Cladonia gracilis ssp. *turbinata*	*Sphagnum squarrosum*
Peltigera neckeri	*Hylocomium splendens*
Peltigera scabrosa	*Tomentypnum nitens*
Peltigera canina	*Splachnum luteum*
Peltigera elisabethae	*Sphagnum fuscum*
Peltigera malacea	*Pleurozium schreberi*
Cladonia amaurocraea	*Dicranum undulatum*
Cladina arbuscula	*Sphagnum riparium*
Cladina rangiferina	*Sphagnum rubellum*
Cladonia cariosa	*Sanionia uncinata*
Cetraria laevigata	*Polytrichum strictum*
Cladonia scabriuscula	*Calliergon cordifolium*
Icmadophila ericetorum	*Sphagnum teres*
Parmelia sulcata	*Sphagnum magellanicum*
	Sphagnum russowii
	Sphagnum warnstorfii
	Polytrichum juniperinum
	Helodium blandowii
	Hamatocaulis vernicosus
	Leptobryum pyriforme
	Aulacomnium turgidum
	Bryum pseudotriquetrum
	Drepanocladus exannulatus
	Meesia uliginosa
	Sphagnum angustifolium
	Sphagnum fimbriatum
	Sphagnum lindbergii

Table F4. Typical cryptogam species found in dry xeric steppe vegetation on south-facing slopes of buttes and hills on FWA.

Lichens	Mosses
Peltigera rufescens	*Rhytidium rugosum*
Cladina stellaris	*Bryum argenteum*
Cladonia uncialis	*Polytrichum piliferum*
Flavocetraria nivalis ssp. *nivalis*	*Tortula ruralis*
Phaeophyscia constipata	*Ceratodon purpureus*
Peltigera leucophlebia	*Abietinella abietina*
Peltigera aphthosa	*Pterygoneurum subsessile*
Peltigera malacea	
Cladonia amaurocraea	
Stereocaulon paschale	
Cladonia pocillum	
Peltigera didactyla var. *didactyla*	
Cetraria muricata	
Cladina aberrans	
Cladonia kanewskii	
Flavocetraria cucullata	
Phaeorrhiza nimbosa	
Physconia muscigena	
Rhizoplaca chrysoleuca	
Vulpicida tilesii	

Table F5. Typical cryptogam species of alpine tundra on FWA.

Lichens	Mosses
Flavocetraria cucullata	*Rhytidium rugosum*
Cetraria laevigata	*Aulacomnium turgidum*
Peltigera aphthosa	*Polytrichum piliferum*
Peltigera malacea	*Hylocomium splendens*
Stereocaulon paschale	*Polytrichum commune*
Cladina rangiferina	*Polytrichum hyperboreum*
Nephroma expallidum	*Racomitrium lanuginosum*
Cetraria islandica	*Tetraplodon mnioides*
Masonhalea richardsonii	*Bryum argenteum*
Cladonia uncialis	*Abietinella abietina*
Flavocetraria nivalis ssp. *nivalis*	*Polytrichum strictum*
Cladonia amaurocraea	*Polytrichum juniperinum*
Peltigera scabrosa	*Ptilium crista-castrensis*
Nephroma arcticum	*Bartramia ithyphylla*
Peltigera lepidophora	*Conostomum tetragonum*
Alectoria ochroleuca	*Encalypta brevicolla*
Arctoparmelia separata	
Asahinea chrysantha	
Bryocaulon divergens	
Dactylina arctica	
*Epilichen scabrosus**	
Lobaria linita var. *linita*	
Ochrolechia upsaliensis	
Parmelia omphalodes	
Pertusaria subobducens	
Solorina crocea	
Sphaerophorus globosus	
Stereocaulon glareosum	
Thamnolia vermicularis	
Peltigera rufescens	
Cladina stellaris	
Cladonia pocillum	
Cladina aberrans	
Cladonia gracilis ssp. *turbinata*	
Stereocaulon alpinum	
Dibaeis baeomyces	
Psoroma hypnorum	
Stereocaulon coniophyllum	
Bryoria nitidula	
Cetraria aculeata	
Cetraria nigricans	
Cladonia borealis	
Cladonia gracilis	
Cladonia gracilis ssp. *gracilis*	
Cladonia singularis	
Hypogymnia subobscura	
Lobaria linita	
Lopadium pezizoideum	
Peltigera didactyla var. *extenuata*	
Schadonia fecunda	
Sphaerophorus globosus var. *globosus*	

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An inventory of the vascular and ground-inhabiting cryptogam flora of Fort Wainwright, in interior Alaska, was conducted during the summer of 1995 to support land management needs related to the impact of training. Primary plant collecting, identification and verification were conducted by the Alaska Natural Heritage Program and the University of Alaska Museum. The work was supervised and the data compiled into a geographic information system by the USA Cold Regions Research and Engineering Laboratory and the USA Waterways Experiment Station.

Fort Wainwright covers 370,450 hectares (915,000 acres); it was divided into five areas: 1) the valleys of a cantonment area of base facilities, 2) the slopes and alpine areas of the Yukon–Tanana Uplands, 3) Tanana Flats and associated wetlands, 4) the upland buttes and Blair Lakes area in Tanana Flats, and 5) the floodplains of the Tanana and Chena Rivers. Over 100 sites were visited, with habitats ranging from very dry south-facing slopes to forest, floodplains, wetlands, and alpine tundra.

Vascular collections represented 491 species (including subspecies and varieties), included about 26% of Alaska's vascular flora, and are considered to be relatively complete. The cryptogam collections included 219 species, representing 92 mosses, 117 lichens, and 10 liverworts. The flora is characteristic of the circumpolar boreal forest and wetlands of both North America and Eurasia, but it also contains alpine and dry-grassland and steppe species.

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