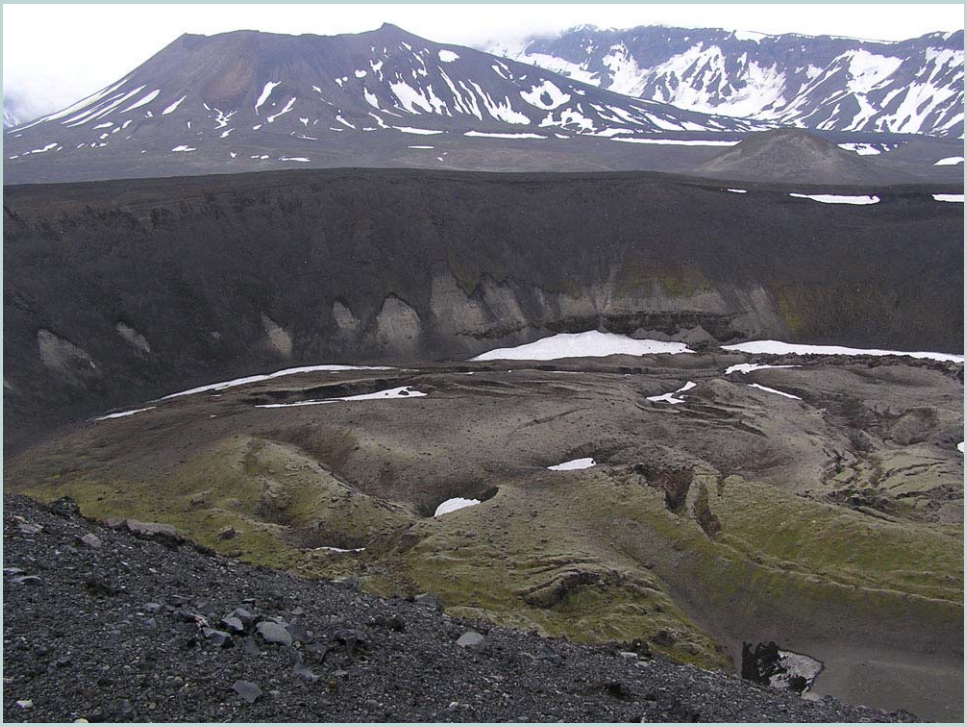
ANIAKCHAK NATIONAL MONUMENT AND PRESERVE
VASCULAR PLANT INVENTORY
FINAL TECHNICAL REPORT



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National Park Service
Southwest Alaska Network
Inventory & Monitoring Program
NPS Report: NPS/AKR/SWAN/NRTR-2005/06

November 2005

Cooperative Agreement No. 1443CA991000013

Funding Source: National Park Service, Inventory & Monitoring Program

SUGGESTED CITATION:

Lipkin, R. 2005. Aniakchak National Monument and Preserve, vascular plant inventory, final technical report. National Park Service, Southwest Alaska Network, Anchorage, AK. NPS/AKR/SWAN/NRTR-2005/06. 41 pp.

TOPIC(S): biological inventories, vascular plants

THEME KEYWORDS: vascular plants, species of conservation concern, biological inventories

PLACE NAME KEYWORDS: Southwest Alaska Network, Aniakchak National Monument and Preserve, Aniakchak Caldera, Aniakchak River, Black Creek Lagoon, the Garden Wall, the Gates, Meshik Camp, Meshik River, Packer's Cabin, Waterfall Creek

ACRONYMS:

I&M	Inventory & Monitoring
SWAN	Southwest Alaska Network
AKNHP	Alaska Natural Heritage Program
ANIA	Aniakchak National Monument & Preserve
KATM	Katmai National Park & Preserve
LACL	Lake Clark National Park & Preserve

INITIAL DISTRIBUTION: Southwest Alaska Network

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ABSTRACT

In 2004 the Alaska Natural Heritage Program (AKNHP) conducted a vascular plant inventory of Aniakchak National Monument and Preserve (ANIA) in accordance with a cooperative agreement with the National Park Service (NPS). The primary goal was to document greater than 90% of the vascular plant species expected to occur within the Park and to significantly improve our understanding of current species distributions, particularly species of special concern. The inventory targeted diverse habitat types and poorly-sampled areas within ANIA. The AKNHP and NPS staff visited ANIA from 1 – 27 July 2004 and sampled intensively within most ecogeographic regions. A total of 389 collections were made representing 247 vascular plant taxa. Duplicate or triplicate sheets are present for many of the collections. Of these taxa, 170 are new records for ANIA. Prior to 2004, ca. 74% of the expected taxa had been documented (237 taxa from an estimated expected flora of 320). After the 2004 field season, the number of known taxa increased to 407, representing 96% of the vascular plant taxa expected in the Park. A number of finds were significant range extensions or species of conservation concern. Fourteen of the taxa are considered rare by the AKNHP, including one species new to Alaska, the moonwort *Botrychium pedunculosum* W.H. Wagner. No introduced plant species were found in ANIA.

EXECUTIVE SUMMARY

The Inventory and Monitoring Program (I&M) of the NPS supported vascular plant inventories to document the occurrence, distribution, and relative abundance of plants occurring in the Southwest Alaska Network (SWAN). The SWAN includes Lake Clark National Park and Preserve (LACL), Katmai National Park and Preserve (KATM), Alagnak Wild River (ALAG), Aniakchak National Monument and Preserve (ANIA), and Kenai Fjords National Park (KEFJ). The inventory was developed to provide baseline information for future monitoring and management of natural resources within the SWAN. In 2001, 2002, 2003, and 2004 the University of Alaska Anchorage (UAA), Alaska Natural Heritage Program (AKNHP) conducted field inventories in LACL, KATM, ALAG, KEFJ, and ANIA under Cooperative Agreement No. 1443CA991000013, Modifications 10, 13, 17, and 30. The primary goal was to document 90% or more of the vascular plant species expected to occur within the parks and significantly improve our understanding of current species distributions. The inventories targeted diverse habitat types and poorly sampled areas. This report covers inventories in ANIA. Discussions of inventories in LACL, KATM, ALAG, and KEFJ units are covered in separate reports (Lipkin 2002, Carlson et al. 2003, Carlson et al. 2004, Carlson et al. 2005).

We inventoried the vascular flora of ANIA by hiking to as many habitat types and geographic areas as possible and collecting specimens that were known to be new records or that were considered significant. Access to collection sites was by fixed-winged aircraft on wheels and floats. At each collection site, data were gathered on site characteristics, including latitude and longitude, associated species, soil conditions, etc. Plants were pressed and dried and catalogued at the Alaska Natural Heritage Program office, Anchorage. Final taxonomic determinations and herbarium mounting of specimens was completed by staff at the University of Alaska Fairbanks Museum (ALA).

A total of 389 specimens were collected, recorded, pressed, and curated by AKNHP in 2004. Duplicate or triplicate sheets exist for many of the specimens. A total of 247 individual taxa are represented and 170 are new records for the Park. Roughly 74% of taxa expected to occur in the Park were known prior to 2004. Following our fieldwork, the percentage of known taxa increased to 96%. A number of finds were significant range extensions or were taxa of conservation concern. Fourteen of the taxa are considered rare by the AKNHP, including one species new to Alaska, the moonwort *Botrychium pedunculosum* W.H. Wagner. No introduced plant species were observed in ANIA.

Key Words –
Aniakchak National Monument and Preserve; Aniakchak Caldera; ANIA; SWAN; inventory; vascular plants; species of conservation concern; range extensions

INTRODUCTION

The NPS I&M Program was established by the US Congress in 1992. The goal of program is to establish baseline information on, and monitor long-term trends in, natural resources in the parks. Biological inventories were conducted to establish data to be used in future monitoring programs, make management decisions, conduct research, and educate the public. To meet these objectives, NPS established three program goals:

- Document at least 90 percent of the species of vertebrates and vascular plants expected to occur in the park,
- Describe the distribution and abundance of species of special concern (e.g., rare or invasive species), and
- Provide information necessary to establish a monitoring strategy, with special reference to particular threats and resource issues within each park.

The AKNHP conducted the vascular plant inventory component of the biological inventories for the SWAN. In 2001 AKNHP botanists inventoried the vascular flora of LACL, followed by inventories of KATM and ALAG in 2002 and KEFJ in 2003. This report covers the floristic inventory of ANIA in 2004, including a description of the regions inventoried, methods employed, the flora encountered, and a discussion of the importance of those finds.

Geologic history of Aniakchak Caldera

Aniakchak National Monument and Preserve is centered on the caldera for which the Monument is named. The Aniakchak volcanic center has been active for at least 850,000 years from one or more stratocones (Neal, et al. 2001). The current caldera was formed approximately 3,500 years during a violent eruption (1,000 times the size of the 1992 Mt. Spurr eruption) that caused the existing stratocone to collapse. Aniakchak is thought to have been the source of at least 40 explosive eruptions in the last 10,000 years, with at least half of them occurring between 10,000 and 3,500 years ago. Most deposits extend north and west of the volcano, consistent with modern prevailing winds. Pumice-rich debris from the eruption 3,500 ybp was deposited as much as 60 km (37 miles) away, with ash identified as far away as the Seward Peninsula, 1,100 km (684 miles) to the north (Riehle et al. 1987). The Caldera is approximately 10 km (6.2 miles) wide and 0.5–1.0 km (1640-3280 feet) deep, ranging in elevation from approximately 320 to 1,350 meters (1050-4430 feet) above sea level.

Historic plant collections in ANIA

Father Bernard Hubbard led the first scientific expedition into the caldera in 1930, a year prior to the last major eruption in May 1931. In his account of the caldera prior to the eruption he described a lush “wonderland” with many warm and hot springs (Hubbard 1931). He returned in the spring of 1931, just a month after the eruption, and described a

scene of devastation-- “an abomination of desolation”-- where thick ash deposits had buried much, if not all, of the vegetation (Hubbard 1932). Hubbard was a geologist and, although he made general notes on the natural history of the area, he does not seem to have made any plant collections. His pre-eruption account does mention a “profusion of flowers, particularly orchids” in the caldera and includes photographs of the lady slipper, *Cypripedium guttatum*.

The first detailed observations of the vascular plants of ANIA were made by Koren Bosworth in 1987 during her study of the vegetation of the Aniakchak Caldera (Bosworth 1987). In addition to a significant collection from the caldera, she also made small collections from the coast (between the mouth of the Aniakchak River and Amber Bay) and from the vicinity of the Cinder River.

Prior to her work, few collections were made in what was to become ANIA. A handful of collections were made by scientists pursuing other studies (e.g. J. Drew at Kujulik Bay, 1965, G. Weiler at Cinder R., 1978, and K.A. Raup at Barabara Creek, 1949; all collections at ALA). Observations and notes on the flora and vegetation had been made by NPS personnel (e.g. J. Dennis 1972, B. Rice and S. Studebaker 1982), but they were brief and lacked vouchers. Following Bosworth, Sowl (1988) made a small collection as part of additional vegetation studies in the caldera, and Hasselbach (1995) made a large collection as part of a detailed study of vascular and nonvascular vegetation in the caldera. Hasselbach also collected several taxa from near Meshik Lake.

MATERIALS AND METHODS

Field work for the AKNHP's vascular plant inventory in ANIA took place from 1–27 July 2004. Compilation of the expected taxa list, site selection, and sampling design was initiated in January of 2004.

Expected and Known Taxa

To gauge progress toward achieving 90% documentation of the expected flora, we needed a list of known and probable taxa for ANIA. Plant collections from the herbarium of the University of Alaska Museum (ALA) and from the herbarium of ANIA (including listings in the ANCS+ database) were compiled in a database, along with selected collections from other herbaria, additional observations, and floristic lists from published and unpublished literature. Collections from ALA were verified for both taxonomic identification and geographic location. Collections from other herbaria were only accepted as documentation if the collections were verified by experienced botanists.

Compiling the expected species list for areas that are poorly known is replete with difficulties. We included documented taxa that occurred within 50 km (31 miles) of the park units. This is a very rough approximation of taxa actually present in the park. Even after revisions were made based on likely habitats and geography, the list undoubtedly omits taxa in the units and includes taxa that are not present. Taxa known from within 50 km of the ANIA boundary, or that were expected to occur in ANIA for other reasons,

were recorded as "Probably Present." Using these criteria we initially determined that the percentage of the total expected flora known to be present in the Park was 74%.

ITIS names have been used in this document, with names used in Hultén (1968) included parenthetically for commonly encountered species.

Sampling Design

In order to attain the goal of documenting 90% of the expected flora, we used the reconnaissance method of floristic survey. This method was recommended as the best approach for plant inventories in all Alaska parks by the Alaska Plant Inventory Working Group (September 2000) and by Catling and Reznicek (2003). The reconnaissance method involves identifying survey areas within landscape units via spatial analysis using the following criteria:

- regionally unique geological or geomorphologic features
- communities or habitats of biological concern
- likely habitats of expected species, as indicated by regional floras and Park collections
- under-represented plant communities in existing inventories
- logistical feasibility (e.g., access, cost)
- potential of certain types of sites to maximize species and communities encountered (e.g., ecotones, high environmental gradient areas)

We selected collection sites to represent a range in variability of ecoregional subsections (Tande and Michaelson 2001), landcover types, wetlands, and plant associations within ANIA. Collection sites were explored by covering the region by foot and by carefully examining all plant species to identify those that were new or noteworthy. Greater time and effort was expended in high diversity and high environmental gradient areas.

This targeted, judgment-based approach is an efficient way to locate populations of species of special concern based on known habitat preferences and patterns of distribution. As surveys progressed, the list of species of special concern was refined, as well as knowledge of species' habitat and geography.

Field Methods

The field personnel consisted of Rob Lipkin, Mike Duffy, and Koren Bosworth (botanists with the AKNHP), and Amy Miller of the NPS Inventory and Monitoring Program, SWAN. Access to the three general collection areas was by fixed wing aircraft on wheels and floats. Data and specimens were collected during a 27 day field season in the summer of 2004 (1-27 July).

- Each site was mapped on an aerial photo or USGS topographic map and a georeferenced point was recorded using a handheld GPS (Garmin Map76). The routes surveyed were also mapped. Data were not differentially corrected.

Representative photos were taken of each site including the plant communities, unusual landforms, and notable plants.

- Each site was recorded and significant landforms and plant associations described. A species list was compiled for most sites, with notes on the abundance and habitat for all taxa collected, as well as other taxa present, where possible.
- Vouchers were collected and curated as discussed below.

Collections were made only if the population was large enough to support removal of individuals following the collecting protocols of Murray and Parker (1990) and Parker and Murray (1992). Rare plant sighting forms with maps were completed for species with an AKNHP state rank of less than 3 ("rare or uncommon," see Appendix III for discussion of Heritage Program ranks).

Vouchers and Curation

The following data were recorded with each vouchered specimen: date, unique collection number, latitude and longitude (NAD27, decimal degrees, taken from a handheld GPS unit); slope, aspect, elevation, topographic position, associated landforms, associated species, vegetation class, substrate, soil moisture, cover class or frequency class, notes on characters not preserved well, associated photo number, phenology, and ecological observations. Each voucher specimen is referenced to a specific geographic locality, generally less than 1,000 m^2 (10,764 ft^2), having a uniform habitat. Collections at each site ranged from single specimens to over twenty taxa.

The size of the population and area surveyed was included for species of concern. Population is defined here as a group of individuals of the same taxon that occupy the same locality separated from other such groups by more than 1 km (0.6 mile). This follows from the definition that NatureServe uses to define "element occurrences."

The first set of collections is archived at the Herbarium of the University of Alaska Museum (ALA). Whenever there was sufficient material, a duplicate, set was sent to the NPS to be housed at its herbarium.

Specimens were given conditional names in the field by AKNHP and NPS staff. Plant collections were later sorted, examined and identified by AKNHP botanists and the collections were then sent to ALA where notable finds and difficult taxa were reviewed by the Museum staff. As needed, specimens were sent out to authorities by ALA for determination. Specimens to be archived at ALA and those to go to Park herbaria were prepared at ALA.

RESULTS

We made a total of 389 collections during the 2004 field season representing 247 vascular plant taxa distributed across 47 families and 127 genera (Appendix II). Duplicate or triplicate sheets are present for many of the collections. Of these taxa, 170 are new records for ANIA. A number of finds were significant range extensions or taxa

of conservation concern. Fourteen of the taxa are considered rare by the AKNHP, including one species new to Alaska, the moonwort *Botrychium pedunculosum* W.H. Wagner, and another taxon that is possibly new to science, (*Polemonium* sp.).

Prior to our efforts, 74% of an estimated 320 expected taxa were known from ANIA. During the 2004 field season, collections were made of 67 of the 84 taxa considered "Probably Present" but not vouchered and 103 new taxa were collected that were not originally predicted to occur in the Park. These collections increase the proportion of documented vascular plant taxa to 95% of those expected to occur. Since 103 of the taxa collected in 2004 were not on the original list of 321 expected taxa, the percentages should actually be 407 taxa documented from a total expected flora of 424, or 96%, satisfying the Park's objective in documenting greater than 90% of the vascular plant taxa in ANIA. These numbers illustrate some of the difficulties in compiling and interpreting the meaning of expected species lists for parks in remote areas. Unexpected range extensions render these lists rough approximations or starting points for discussions and future studies. It is only by actively surveying representative regions and habitats of the park that we can gain a realistic idea of the expected flora. Additional, targeted floristic inventories would likely reveal additional, unexpected, taxa new to the Park.

A list of confirmed and expected taxa in ANIA prior to 2004 fieldwork is presented in Appendix I. An annotated species list describing all taxa and the basic topographic and habitat attributes is presented in Appendix II. AKNHP rare plant rankings are shown in Appendix III.

Site Descriptions

After evaluating the locations of previous collections and giving consideration to logistic limitations, we decided to concentrate our sampling in three general collection regions (Fig. 1). The primary collection region was the Meshik River lowlands and the uplands and ridges on the south side of the Aniakchak Caldera, including the Waterfall Creek and Rainbow Creek uplands and the Garden Wall ridge. The second collection region was the Aniakchak Caldera including the wetlands and meadows around Surprise Lake as well as the various tephra plains, lava domes and related habitats in the caldera. The last collection region was the Aniakchak Bay area, from the coastal headlands near the Packers' Cabin, south along the beach meadow strand and estuarine areas to Black Lagoon, and extending a short way up the Aniakchak River (Figure 1).

These regions allowed us to sample sites in a broad array of habitats that included four of the five ecological subsections in ANIA (Tande and Michaelson 2003).

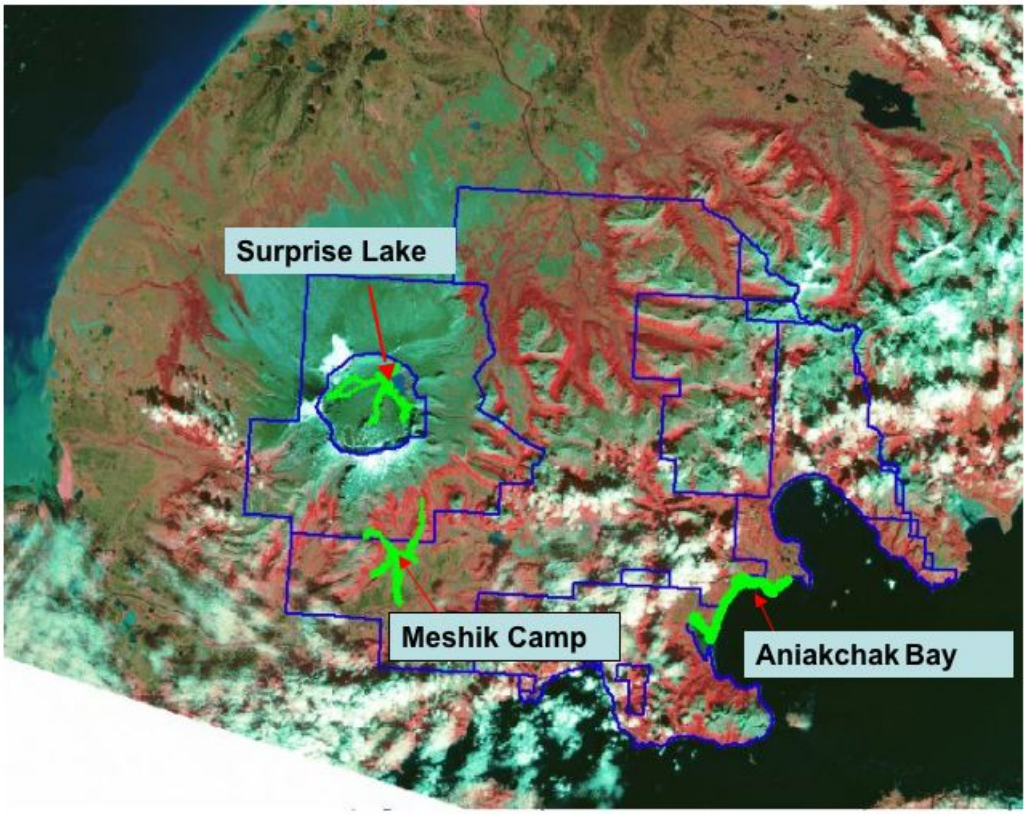

Figure 1. Landsat image of ANIA showing survey routes in the three collection regions (2004).

Meshik River Lowlands and Adjacent Uplands

The Meshik River Lowlands are located in the southwestern quadrant of ANIA (Fig. 1). The Lowlands comprise the low-lying areas of the Meshik River Valley, from Meshik Lake at the base of Pinnacle Mountain, to the mouth of the river at Port Heiden. Elevations range from approximately 30 m (98 ft.) near the river to almost 1000 m (3280 ft.) on the ridges radiating from the Caldera. The Lowlands support fens, riparian and lacustrine wetlands, ash barrens, ericaceous heath, and shrublands. The adjacent sedimentary and volcanic uplands and ridges flanking the south side of Aniakchak Caldera support alpine seeps, scree, outcrops, fellfield and tundra.

We inventoried this region from 1-10 July 2004. Joe Klutsch's Meshik Camp, located on Rainbow Creek, served as our base of operations. The camp is located south of the Caldera, 4.5 km (2.8 miles) north of the Meshik River and 3 km (1.9 miles) southwest of the Garden Wall. Survey routes are shown in Figure 2.

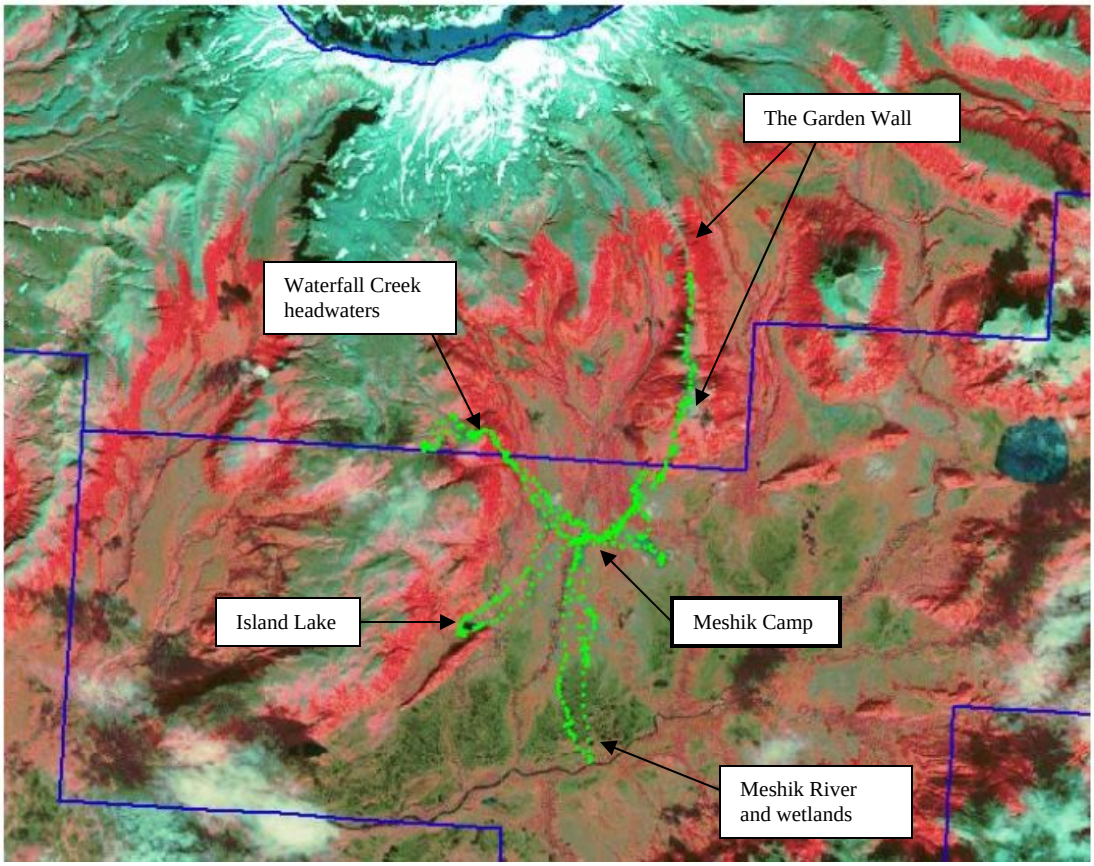

Figure 2. Survey routes in the Meshik River Lowlands and adjacent Uplands.

Wetlands

The Meshik River Lowlands support a wide variety of wetlands. These habitats were targeted for collections, as wetland species are typically poorly represented in herbaria. Gravel bars, creek banks and sloughs were common along Rainbow Creek, Cub Creek, and the Meshik River. Palustrine wetlands and fens ranging from saturated to flooded, with water depths to over 50 cm (20 inches), occurred in the intervening areas between these drainages. Sites were dominated by a variety of sedges, grasses and forbs, and extended south-southwest to the Meshik River and an unnamed small lake. Frost boils and hummocks (Fig. 3) resulted in microtopographic variation that supported high species richness. Areas with shallow or no standing water were dominated by sedges, including *Carex aquatilis, C. pluriflora, C. gynocrates, C. limosa*, and *Trichophorum caespitosum*. Areas with deeper standing water (Fig. 4) graded into communities that supported graminoids *Carex lyngbyei* and *Dupontia fisheri* (=*D. fisheri* ssp. *psilosantha*), and forbs *Menyanthes trifoliata, Pedicularis sudetica* ssp. *pacifica* (=*P. pacifica*) and *P. parviflora* ssp. *pennellii.*

Figure 3. Frost boils in ephemeral wetland, Meshik Lowlands. Variation inmicrotopography and soil moisture resulted in high species richness in these areas.

Figure 4. *Equisetum fluviatile* (water horsetail) and *Arctophila fulva* (pendantgrass) in pond, Meshik Lowlands.

Ericaceous heath tundra

Stabilized ash deposits supported ericaceous heath tundra communities dominated by low shrubs and forbs, including *Empetrum nigrum, Dryas integrifolia, Salix arctica, Vaccinium vitis-idaea, V. uliginosum, Petasites frigidus,* and *Packera cymbalaria (=Senecio resedifolius)* (Fig. 5a-b). Mosses and lichens occupied old frost mounds and other microtopographic features.

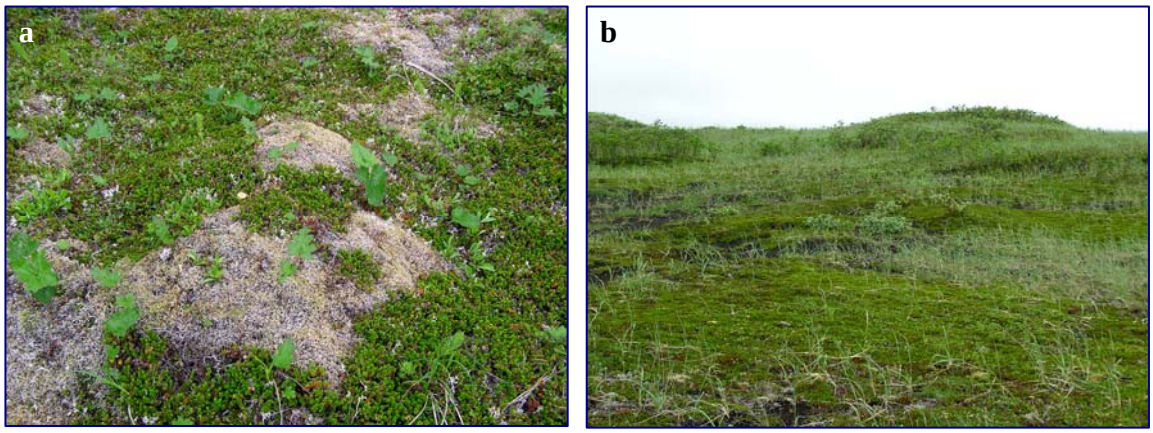

Figure 5. (a) *Empetrum nigrum* (crowberry) and *Petasites frigidus* (Arctic sweet coltsfoot) in ericaceous heath, Meshik Lowlands. (b) *Empetrum* heath intergrades with *Leymus mollis* (beach rye) on exposed cinders, Meshik Lowlands.

Ash fields and cinder flats

Large ash deposits blanket the outer slopes of Aniakchak Caldera and the surrounding plains. In many areas these deposits are exposed as sparsely vegetated ash or cinder fields with a forb-graminoid component (Fig. 6a-b). Common species included graminoids *Leymus mollis (=Elymus mollis), Deschampsia caespitosa, Festuca brachyphylla, F. richardsonii,* and forbs *Armeria maritima, Minuartia macrocarpa, Oxytropis nigrescens (=O. bryophila), O. borealis var. sulphurea (=O. viscida), Chamerion angustifolium*

(=Epilobium angustifolium), Artemisia campestris var. *borealis* (*=A. borealis*), *Rumex beringensis, Lupinus nootkatensis,* and shrubs *Salix glauca* and *S. ovalifolia.*

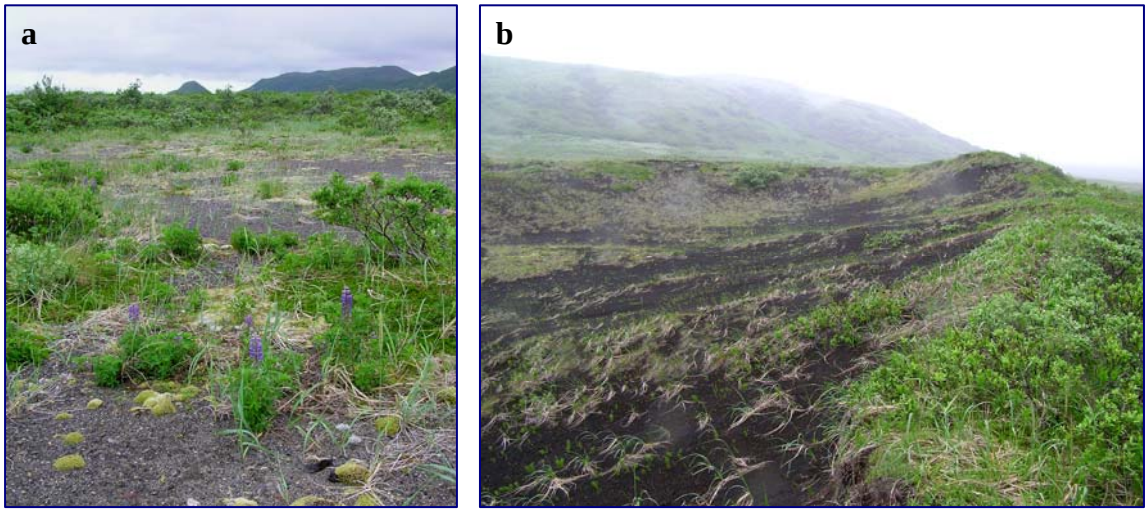

Figure 6. (a) *Leymus mollis* (beach rye), *Lupinus nootkatensis* (Nootka lupine) and *Salix glauca* (grayleaf willow) colonization on cinder field, Meshik Lowlands. (b) *Leymus mollis* on cinder dune/blowout, Meshik Lowlands.

Gravel bars and riparian areas

Gravel bars along creeks are also sparsely vegetated with graminoids and forbs. Dominants included grasses *Deschampsia caespitosa, Festuca brachyphylla, F. richardsonii,* and *Alopecurus aequivalis,* and forbs *Montia chamissoi* (*=Claytonia chamissoi*), *Veronica americana,* and *Chamerion angustifolium (=Epilobium angustifolium).* Creek and river banks were characterized by moist to wet graminoid-herbaceous meadows and willow (*Salix alaxensis, S. barclayi, S. commutata, S. pulchra*) or Sitka alder (*Alnus viridis* ssp. *sinuata*) thickets with dense herbaceous understories.

Uplands and ridges

Ridges and slopes of Aniakchak Caldera, including the Garden Wall and those above Waterfall Creek, have lush graminoid forb meadows on lower slopes, extending up into subalpine and alpine communities. Upland environments included screes, outcrops, and fellfields (Fig. 7a), often with solifluction features. Typical species of the alpine fellfields and screes were graminoids *Carex circinata, Luzula arcuata,* and *L. spicata,* dwarf shrubs *Salix rotundifolia, S. reticulata* and *S. arctica,* and forbs *Geum rossii, Saxifraga bronchialis, S. eschscholtzii,* and *Silene acaulis* (Fig. 7b). Interfluvial areas and terraces supported shrub thickets and ericaceous heath tundra. Rock outcrops supported additional species, including *Draba borealis, D. lonchocarpa*, *Saxifraga eschscholtzii*, *S. flagellaris*, and *Douglasia alaskana* (G3/S3).

Figure 7. (a) Alpine fellfield, the Garden Wall, south of Aniakchak Caldera. (b) *Silene acaulis* (moss campion), a common alpine species.

Mesic meadows

Moist herbaceous-graminoid meadows occupied many toeslope areas and low ridges (Fig. 8a). Dominant species included graminoids *Calamagrostis canadensis*, *Elymus trachycaulus* ssp. *trachycaulus* (*=E. trachycaulus ssp. majus), Poa palustris, Phleum alpinum, Carex macrochaeta*, and *C. pachystachya,* and forbs *Galium triflorum, Heracleum maximum (=H. lanatum)* and *Actaea rubra*. Several species of moonwort (*Botrychium*), including *Botrychium lunaria and B. virginianum* (G5 S2S3; Fig. 8b) were found in the understory. In addition, a *Botrychium* new to Alaska (*B. pedunculosum*; G2G3 S1) was found in this meadow type (see Discussion, Species of Conservation Concern).

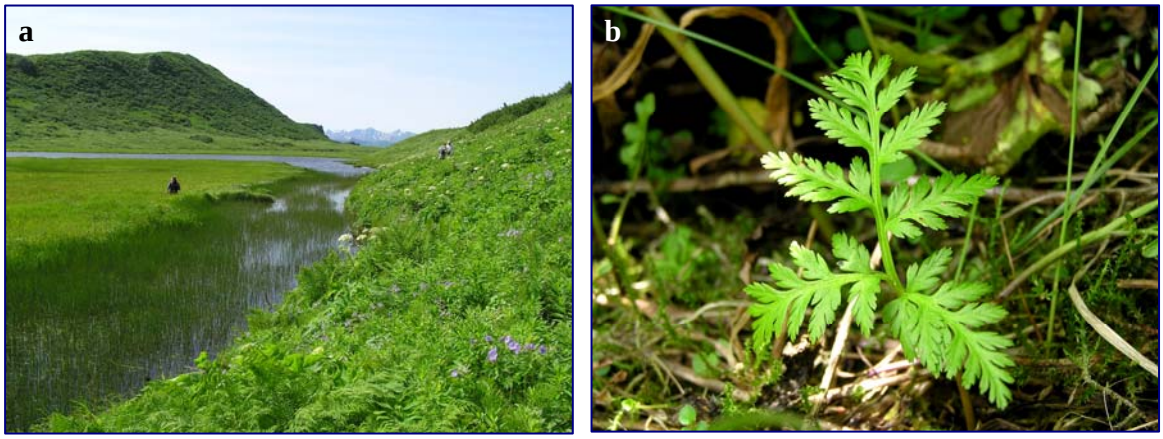

Figure 8. (a) Mesic meadow (right) and emergent wetland (left) at 'Island Lake' near Waterfall Creek, Meshik Lowlands. This site supported two rare moonworts, *Botrychium pedunculosum* (new species for Alaska) and *B. virginianum*. (b) *Botrychium virginianum* (rattlesnake fern) in mesic meadow-alder understory, Meshik Lowlands.

Aniakchak Caldera

The Aniakchak Caldera consists primarily of depauperate, wind-scoured cinder plains and ridges. The 10 km-radius caldera floor is characterized by flat- to gently-sloping

cinder fields, cinder and spatter cones, and dacite flows. Portions of the interior rim not buried by volcanic deposits consist of Jurassic to Tertiary sedimentary and igneous rocks (Detterman et al. 1981, 1987). Elevations within the Caldera range from 320 to 1,350 m (1050-4430 feet). The vegetation surrounding Surprise Lake and the headwaters of the Aniakchak River includes subarctic lowland wet sedge meadow, lowland wet herb meadows, lush headlands and terraces, open low willow shrublands, and mesic mixed herb communitites (Bosworth 1987; Hasselbach 1995). The Caldera was inventoried from 11-19 July 2004 (Fig. 9), from a camp on the northwest shore of Surprise Lake.

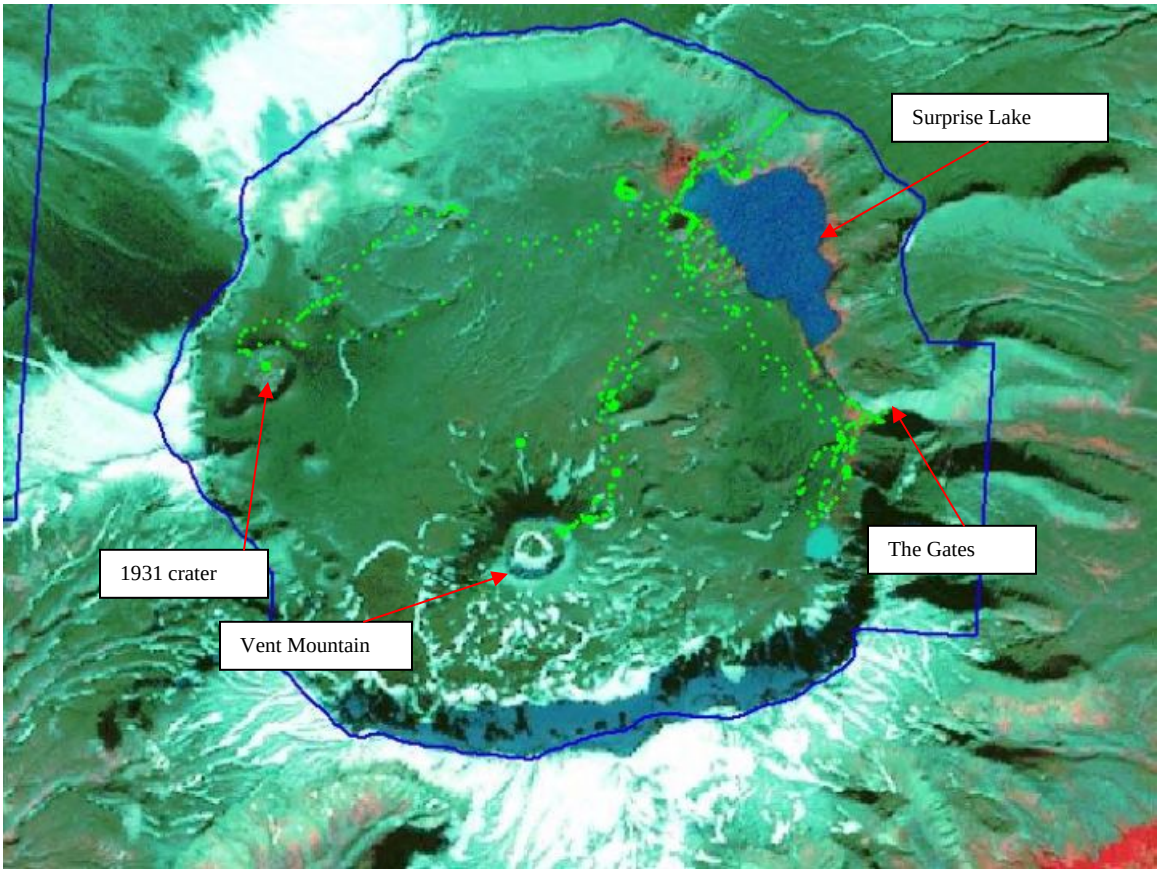

Figure 9. Survey routes in the Aniakchak Caldera.

Vegetation groups identified by Hasselbach (1995) provide the basis for community descriptions in the Aniakchak Caldera.

Mesic mixed forb and lowland herb meadow

Moist meadows dominated by graminoids, forbs, mosses and widely scattered shrubs (*Salix alaxensis*) occurred on toeslopes and low-lying flat areas, such as at the the inlet and outlet of Surprise Lake (Figs. 10-11). Dominant herbaceous species included forbs *Lupinus nootkatensis, Angelica lucida, Arabis lyrata,* and graminoids *Arctagrostis latifolia* and *Carex macrochaeta.*

Figure 10. Mesic meadow near the inlet to Surprise Lake (foreground). Ephemeral pools on sandbars and low terraces (background) support a unique suite of mesophytic species, described below.

Figure 11. Mesic sedge meadow above the inlet to Surprise Lake. AKNHP Botanist Rob Lipkin and Koren Bosworth examine a species of *Carex*.

Shallow/ephemeral pools and saturated sand

Shallow pools in the braided channels and bars near the inlet of Surprise Lake created habitat for the grass *Deschampsia beringensis* and forbs *Koenigia islandica, Ranunculus hyperboreus* var. *hyperboreus, Montia fontana* ssp. *fontana* and *Limosella aquatica* (G5 S3) (see Discussion, Species of Conservation Concern).

Mesic mixed forb-shrub headlands

Headlands and steep embankments surrounding Surprise Lake supported lush, mesic mixed forb-graminoid communities. Dominant species included forbs *Heracleum maximum* (*=H. lanatum*), *Saxifraga punctata punctata, Solidago multiradiata*, and shrubs *Salix barclayi* and *S. arctica*. *Botrychium alaskense* (G2G3 S2S3) was found at several locations in this community type (see Discussion, Species of Conservation Concern).

Eruption pits and high-relief lava fields

Late snowmelt in these barren areas supported a rich nonvascular flora dominated by the lichen *Stereocaulon vesuvianum*, but few vascular plants (e.g., *Salix stolonifera*, S. *rotundifolia*, *Carex pyrenaica*, *Luzula piperi*, and *Cystopteris fragilis*) (Fig. 12a, b). Vegetated areas of the 1931 eruption site (Fig. 12a) included graminoids *Carex pyrenaica* ssp. *micropoda*, *Poa paucispicula, Festuca brachyphylla*, forbs *Oxyria digyna, Minuartia macrocarpa, Saxifraga foliolosa*, and *S. caespitosa*, and low shrubs including the aforementioned willows and *Salix glauca, S. ovalifolia,* and *S. reticulata*.

Cinder cones

Exposed, steep cinder slopes supported few vascular species, including graminoids *Luzula piperi* and *L. arcuata*, and forbs *Chamerion latifolium* (*=Epilobium latifolium*), *Cardamine bellidifolia, Sibbaldia procumbens,* and *Arnica lessingii* (Fig. 12c). *Leymus mollis* was scattered near the base of many of these slopes. An unusual white-flowered *Polemonium* resembling *Polemonium boreale* (*=P. boreale* var. *villosissimum*) was common on northern and northwestern aspects (Fig. 12d; see Discussion, Species of Conservation Concern).

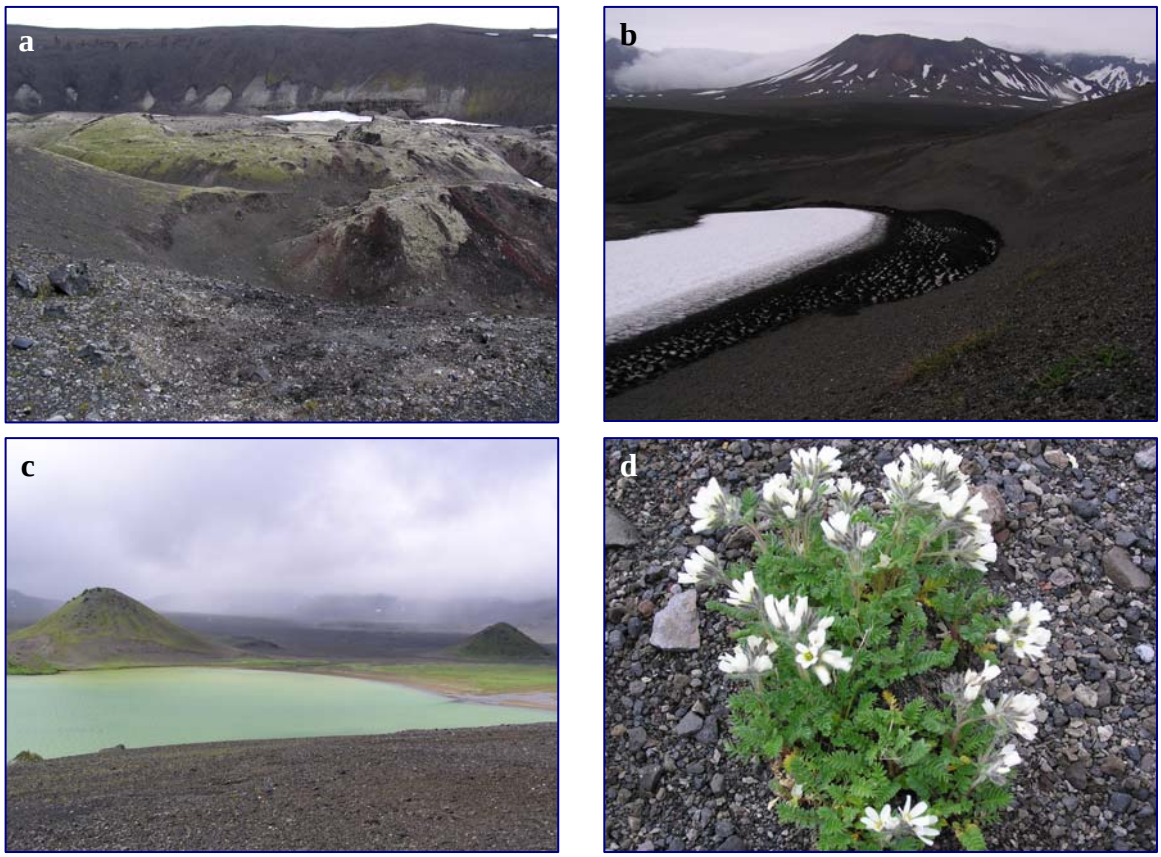

Figure 12. (a) Light-colored lichen (*Stereocaulon vesuvianum)* and sparse vegetation at 1931 Eruption site, Aniakchak Caldera. (b) Late-melting snow in a drainage east of the 1931 Eruption site and early establishment of *Luzula piperi* (Piper's woodrush). (c) Cinder cones at the north end of Surprise Lake showing herbaceous vegetation, primarily grasses, on side slopes. (d) White-flowered jacob's ladder (*Polemonium boreale* cf. *villosissimum)*.

Ephemeral drainages and snowbeds

Low angle, moist microsites and swales on cinder ridges, benches and toeslopes supported a range of herbaceous and ericacous species (Fig. 13), including grasses *Deschampsia caespitosa* and *Trisetum spicatum*, dwarf shrubs *Empetrum nigrum, Phyllodoce aleutica, Rhododendron camtschaticum,* and *Luetkea pectinata,* and scattered forbs (e.g., *Antennaria alpina* (*=A. pallida*), *Aster sibiricus*).

Cinder fields and dunes

Dry, low angle cinder fields and dunes were found throughout the Caldera and supported scattered forbs including *Papaver radicatum ssp. alaskanum* (*=P. alaskanum*), *Campanula uniflora, Potentilla villosa,* and graminoids *Deschampsia caespitosa* and *Leymus mollis* (Fig. 14). Windswept ash pavement supported virtually no vascular or nonvascular plant cover.

Figure 13. Moist swale-drainage west of Surprise Lake, Aniakchak Caldera.

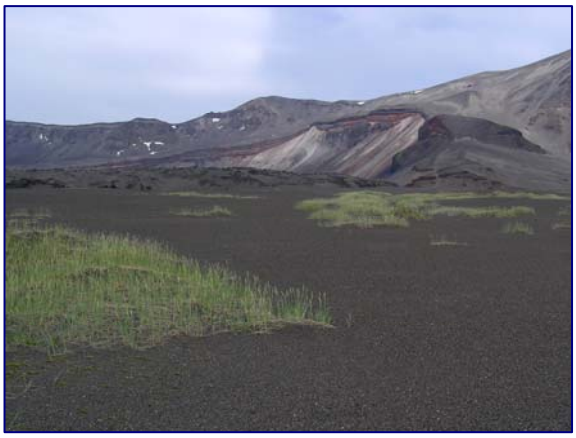

Figure 14. *Leymus mollis* (beach rye) on cinder field, Aniakchak Caldera.

Shallow/ephemeral pools and saturated sand

Shallow pools in the braided channels and bars near the inlet of Surprise Lake created habitat for the grass *Deschampsia beringensis* and forbs *Koenigia islandica, Ranunculus hyperboreus* var. *hyperboreus, Montia fontana* ssp. *fontana* and *Limosella aquatica* (G5 S3) (see Discussion, Species of Conservation Concern).

Midslope caldera walls

Steep, well-drained slopes of the caldera walls supported ubiquitous species including forbs *Antennaria monocephala, Arnica lessingii, Empetrum nigrum, Geum rossii*, and *Minuartia macrocarpa*, and graminoids *Luzula arcuata* ssp. *unalaschensis*. *Aphragmus eschscholtzianus* (G3 S3) was also found in this habitat (see Discussion, Species of Conservation Concern).

Aniakchak Bay Coastal Lowlands

The Aniakchak Bay Coastal Lowlands are located in the southeastern quadrant of ANIA (Fig. 1) and consist of low-gradient coastal areas and floodplains on a complex of beach, estuarine, outwash and alluvial deposits. Topographic features include hills, benches, and stabilized dune deposits. Elevations range from 0-120 m (0-394 feet) above sea level. This region supports mesic forb-graminoid meadows on coastal headlands and bluffs, ericaceous heath on stabilized dunes, perennial and tidally-influenced wetlands, shrublands, beach communities, and riparian communities, including gravel bars. Lowland sites within approximately 10 km (6 miles) of the Packer's Cabin on Aniakchak Bay were inventoried from 19-27 July, 2004 (Fig. 15).

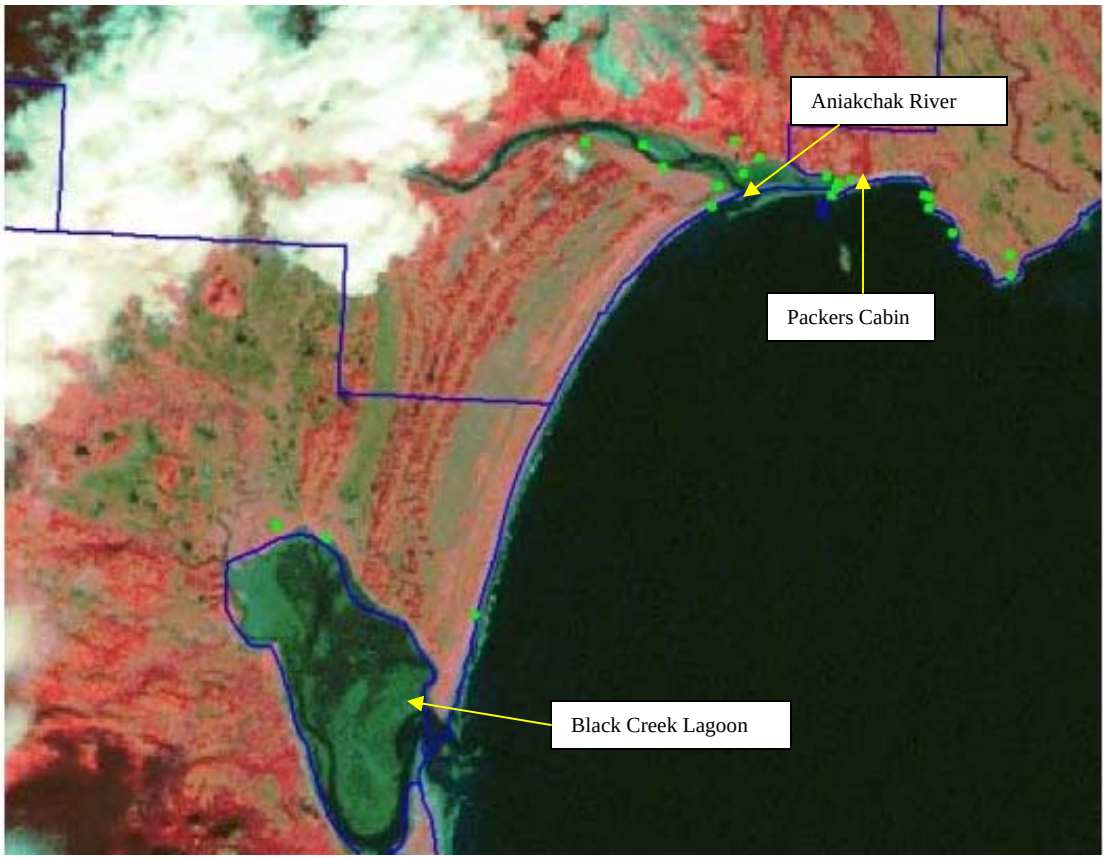

Figure 15. Survey routes in the Aniakchak Bay Coastal Lowlands.

Coastal headlands and bluffs – mesic meadows

Moist herbaceous-graminoid meadows were found on coastal bluffs, hillslopes, embankments, and dune ridges. A dense canopy of Sitka alder (*Alnus viridis* ssp. *sinuata*) was common on slopes and in drainages. Meadow types ranged from lush tall forb-graminoid (Fig. 16a-b; e.g., *Bromus ciliatus, Heracleum maximum* (=*H. lanatum*), *Phegopteris connectilis* (=*Thelypteris phegopteris*), *Equisetum arvense, Polemonium acutiflorum, Solidago canadensis* var. *lepida* (=*S. lepida*), *Artemisia tilesii, Geranium erianthum, Cypripedium guttatum* (Fig. 16c)) to drier, more wind exposed sites dominated by lower-stature plants (Fig. 16d; e.g., *Salix barclayi, Empetrum nigrum, Anemone narcissiflora* ssp. *villosissima, Polygonum viviparum*). *Thalictrum alpinum* was found adjacent to rock outcrops above the Aniakchak River. *Orobanche uniflora* (G5/S2), a parasitic species known in Alaska only from Simeonof, Afognak and Kodiak Islands, was found in the understory at two sites, associated with *Solidago* and *Artemisia* (see Discussion, Species of Conservation Concern).

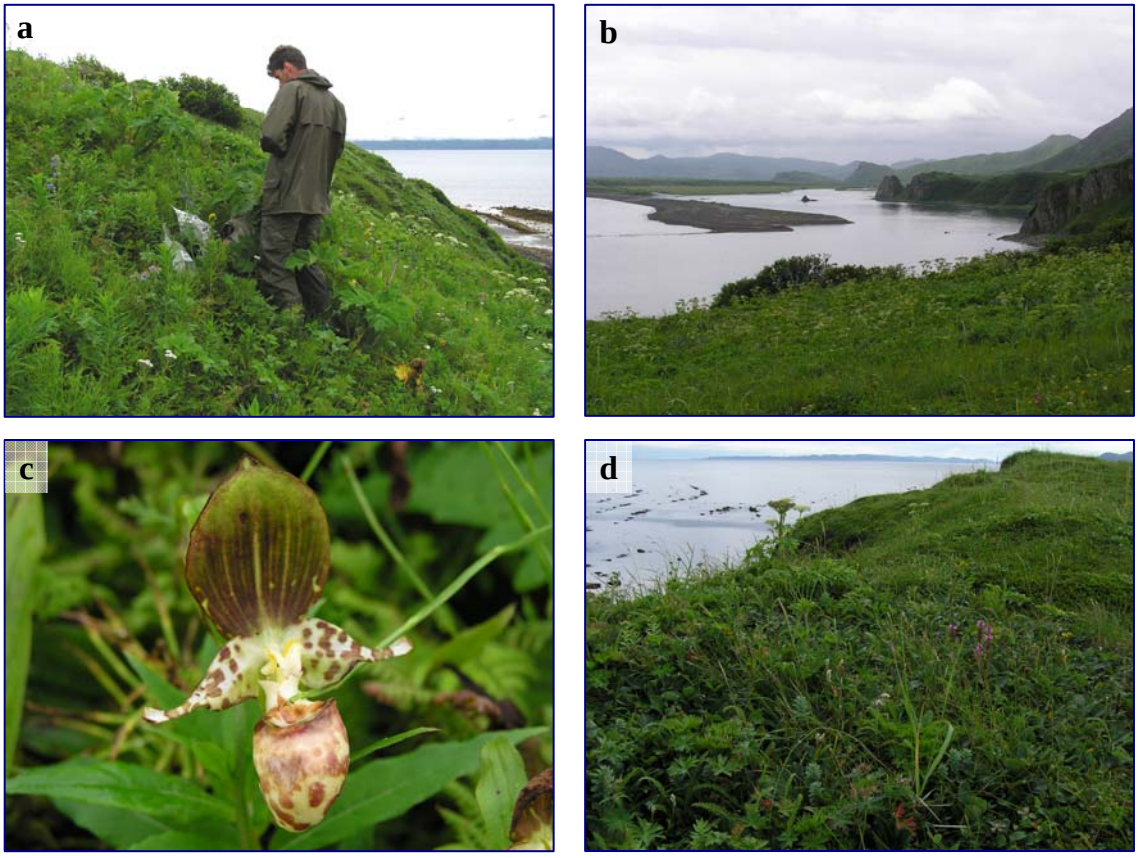

Figure 16. (a) Mike Duffy records collects specimens in a tall forb-graminoid mesic meadow, coastal headlands, Aniakchak coast. (b) Tall forb-graminoid community at mouth of Aniakchak River. (c) *Cypripedium guttatatum* (spotted lady's slipper) in tall forb-graminoid mesic meadow. (d) Windswept coastal headlands support lower-stature vegetation.

Tidally-influenced and freshwater wetlands

Brackish wetlands, such as those at the margin of Black Creek Lagoon (Fig. 17a), were dominated by graminoids *Puccinellia nutkaensis, P. phryganodes* and *Carex glareosa*, and forbs *Triglochin maritima, Argentina egedii ssp. egedii* (=*Potentilla egedii*), and *Plantago maritima*. Freshwater wetlands included ponds, fens, sphagnum bogs, and seasonally flooded meadows. Riparian vegetation on the banks of the Aniakchak River was similar to that described for gravel bars, below. Emergent and aquatic species included *Carex lyngbyei, C. saxatilis, Equisetum fluviatile, Isoetes tenella* (=*I. echinospora*), *Subularia aquatica, Utricularia minor*, and *Hippuris tetraphylla* (Fig. 17b). *Dupontia fisheri* (=*D. fisheri* ssp. *psilosantha*), *Carex mackenziei, C. ramenskii*, and *C. pluriflora* were found in adjacent wet meadows.

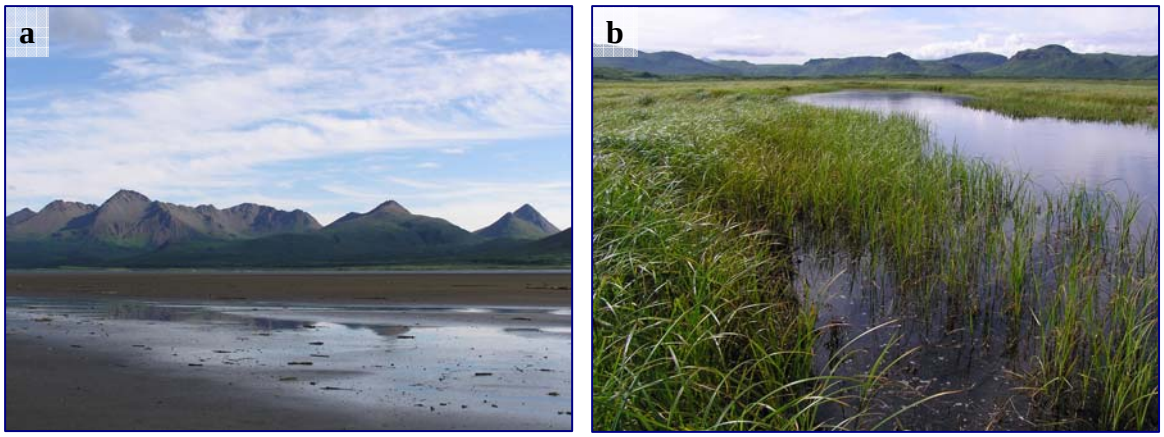

Figure 17. (a) Black Creek Lagoon, Coastal Lowlands, showing mudflats at low tide. (b) *Carex lyngby.ei* (Lyngbye's sedge) and *Ruppia cirrhosa* in a freshwater pond behind Black Lagoon.

Beach, cliff, and dune communities

Common beach species included graminoids *Leymus mollis* (=*Elymus mollis*), *Hordeum brachyantherum*, and *Carex macrocephala*, and forbs *Senecio pseudoarnica*, *Honckenya peploides* (Fig. 18a), *Cakile edentula*, and *Mertensia maritima*. Cliffs (Fig. 18b-c) supported *Deschampsia caespitosa*, *Cochlearia groelandica* (=*C. officinalis* ssp. *oblongifolia*), and *Chamerion latifolium* (=*Epilobium latifolium*). Old dune deposits to the south of the Aniakchak River supported ericaceous heath (*Empetrum nigrum*) in the swales. Intertidal areas supported marine species *Zostera marina* and *Phyllospadix serrulatus* (G4 S2; see Discussion, Species of Conservation Concern).

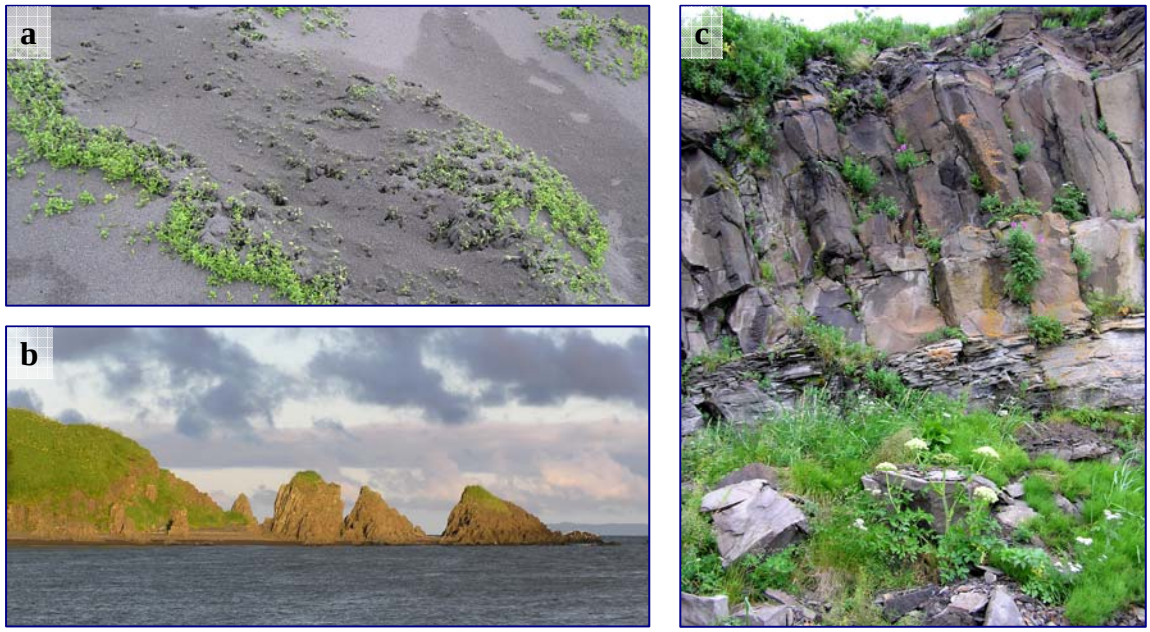

Figure 18. (a) *Honkenya peploides* (sea sandwort) buried by sand in the upper tidal zone. (b) Rocky headlands at the mouth of the Aniakchak River, Coastal Lowlands. (c) Cliff community, mesic forb-graminoid.

Gravel bars
Islands and bars near the mouth of the Aniakchak River supported rich shrub-forb-graminoid communities. Shrubs (*Salix commutata, S. alaxensis, Alnus viridis* ssp. *sinuata*) comprised an open overstory on larger islands. Common graminoids included *Deschampsia caespitosa, Festuca richardsonii*, and *Juncus castaneus*. Forbs included *Equisetum arvense, E. variegatum, Mimulus guttatus, Artemisia tilesii*, and *Polemonium acutiflorum*. *Plagiobothrys orientalis* (G3G4/S3) and *Limosella aquatica* (G5 S3) occupied fine, wet sediments (see Discussion, Species of Conservation Concern).

DISCUSSION

Species of Conservation Concern

We collected thirteen species of conservation concern during the 2004 inventory; seven of which are rare globally (Heritage Program rank G1–G3) and five which are common globally but rare within Alaska (Heritage Program rank S1-S3). AKNHP ranks for rare species are provided in Appendix III. An additional taxon found in the Aniakchak Caldera appears to be a local variant of *Polemonium boreale* var. *villosissimum*.

Aphragmus eschscholtzianus Andrz. (G3 S3)

Aphragmus eschscholtzianus (Aleutian cress) was found in one small population at the Gates, inside Aniakchak Caldera (56.90313 °N, 158.07821 °W; elev. 400 m), on a steep, sparsely vegetated, northwest-facing limestone scree slope (Fig. 19a). The species was growing in association with *Saxifraga rivularis, S. oppositifolia, Cardamine bellidifolia,* and *Romanzoffia unalaschensis.* We counted fewer than 40 plants, and all were vegetative or in early flower (Fig. 19b).

This rare member of the mustard family is endemic to Alaska and the adjacent southwest Yukon Territory. In Alaska it is principally found on moist to wet alpine screes and cliffs saturated with snow melt, and along streams in the alpine, from the Aleutian Islands, east along the Alaska Peninsula, Alaska Range, Chugach and Wrangell Mountains, and disjunctly to the Seward Peninsula and Brooks Range (Fig. 24a). It is typically found on limestone, and this site near the Gates was one of the few accessible limestone exposures in ANIA. Although it is nowhere common, this species has been found at an increasing number of scattered sites in alpine areas within its range. This species is the only North American representative of the genus. The remaining six species of *Aphragmus* are found in the Himalayas and Siberia.

Figure 19. (a) Steep limestone scree slope that supported a small population of *Aphragmus eschscholtzianus*, The Gates, Aniakchak Caldera. (b) *Aphragmus eschscholtzianus* in the early stages of flowering.

Botrychium alaskense Wagner & Grant (G2G3 S2S3)

We found ANIA to be unusually rich in *Botrychium*s, with seven species found both inside the Caldera and on the surrounding slopes and lowlands, often in great abundance. *Botrychium alakense* (Alaska moonwort) was found at two sites outside the Caldera on cinder ridges, one near Joe Klutsch's Rainbow Creek camp (56.76743 °N, 158.08405 °W; Fig. 21a-b), and one east of Rainbow Creek (56.77547 °N, 158.06409 °W; elev. 60 m), and at three clustered sites inside the Caldera near Surprise Lake, one in herbaceous meadow and crowberry heath on the west side of the lake (56.9299 °N, 158.13213 °W; elev. 330 m), and two in graminoid-forb meadows on the northeast end of the lake (56.93364 °N, 158.10837 °W; elev. 360 m).

Figure 21. (a) Cinder dune with rich *Botrychium* understory at Meshik Camp. (b) *Botrychium* spp., including *B. alaskense* from Meshik Camp dune.

The moonworts were often difficult to see in the understory, making population size difficult to estimate. However, at least 30-50 individuals of *Botrychium* were readily seen at most sites, with more likely present. At all but two of the sites, *B. alaskense* (Fig. 22a) was found growing in association with four other species of *Botrychium*: *B. lanceolatum*,

B. lunaria, B. minganense, and *B. pinnatum.* At the site east of Rainbow Creek, it was growing with *B. lanceolatum* and *B. lunaria,* and at one of the sites on the northeast end of Surprise Lake it was found with *B. lanceolatum* and *B. lunaria.* The species was locally common at all sites except Rainbow Creek.

Botrychium alaskense is endemic to Alaska and was orignally described in 2002, at which time it was only known from a few sites in Interior Alaska. Since then it has been found at a number of new sites, primarily in the Alaska Range and adjacent areas of Interior Alaska, but also as far west as the Telaquana Badlands (LACL) and into Southeast Alaska (Fig. 24b). It is still known from fewer than 25 locations and seems unlikely to be widespread.

***Botrychium pedunculosum* W.H. Wagner (G2G3 S1)**

Botrychium pedunculosum (stalked moonwort) was found at only one location in ANIA, on a southeast facing slope above "Island Hill Lake" near Waterfall Creek (56.75211 °N, 158.12126 °W; elev. 35 m) (Fig. 8a; Fig. 22b). It was rare and growing in the understory of a tall herbaceous meadow, with *Calamagrostis canadensis, Heracleum maximum, Geranium erianthemum,* and *Chamerion angustifolium.* This site also contained *B. lunaria* and *B. virginianum* (Fig. 22c; see below).

The collection of *B. pedunculosum* was perhaps the most remarkable find of the inventory, as it is the first report of this species from Alaska. The species is known from fewer than 20 locations worldwide, ranging from central British Columbia, southern Alberta and Saskatchewan, south to Oregon, Montana and Idaho (Fig. 23). A disjunct population is also known from northeast Quebec. It is reported as rare in all locations, and many locations face portential threats from logging and road activity. Recent molecular work (D. Farrar *pers. comm.*) has shown that the Quebec specimens contain a unique allele not seen in western populations, suggesting a long period of isolation. The similarly disjunct population at ANIA should be investigated to see if it also shows unusual isozyme variation.

***Botrychium virginianum* L. (Sw.) (G5 S2S3)**

Botrychium virginianum (rattlesnake fern) was found at only one site in ANIA, at the same site as *B. pedunculosum,* near Waterfall Creek (56.75211 °N, 158.12126 °W; elev. 35 m) (Fig. 8a-b). It was rare and growing in the understory of a tall herbaceous meadow-*Alnus sinuata* thicket (Fig. 22c) with *Calamagrostis canadensis, Heracleum maximum, Geranium erianthemum,* and *Chamerion angustifolium.* This species is common globally and is found in Eurasia, South America and in North America, from the east coast to British Columbia and the Yukon Territory. It is uncommon or rare in Alaska, where it is known from sites in Southeast, the Alaska Range, and Southcentral Alaska (Fig. 24c). The only other report from the Alaska Peninsula is from the Sandy River (near Chignik), north of ANIA. Sporophores have not been reported from Alaska.

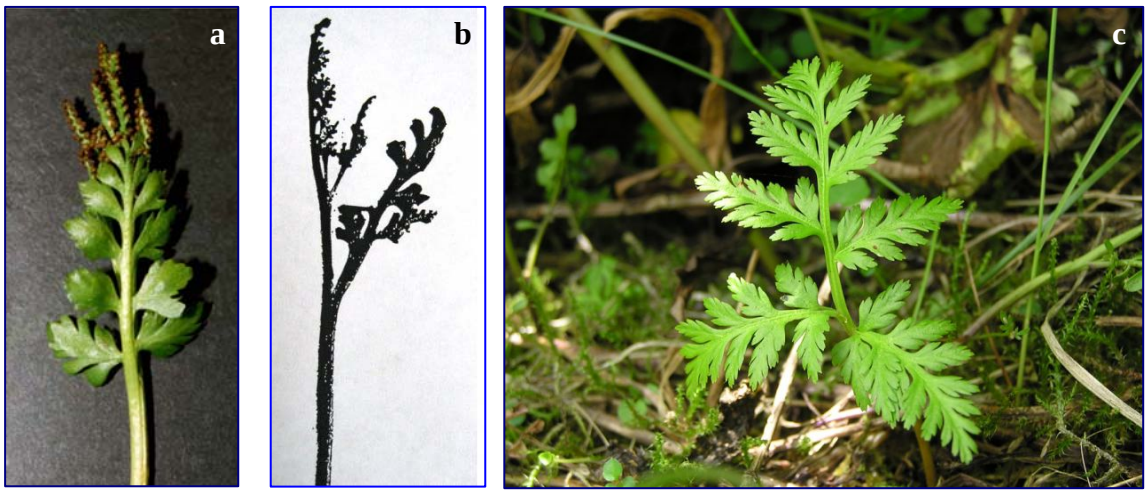

Figure 22. (a) *Botrychium alaskense*. (b) *Botrychium pedunculosum*. The ANIA collection is the first from the state of Alaska. The closest known collection is from south central British Columbia. (c) *Botrychium virginanum* found in a mesic meadow-alder understory near Waterfall Creek.

Figure 23. Distribution of *Botrychium pedunculosum* in North America. (*http://www.public.iastate.edu/~herbarium/botrychium/B-pedunculosum-1-21-05.pdf*; accessed 29 January 2007). Arrows denote disjunct populations. The ANIA collection is shown in red.

Douglasia alaskana (Colville & Standl. ex Hultén) S. Kelso (G3 S3)

Douglasia alaskan (Alaskan rock jasmine), an early-flowering member of the primrose family, was collected from a rock outcrop above the north side of "Island Hill Lake" (56.74721 °N, 158.12148 °W; elev. 100 m) where it was growing with *Potentilla villosa* and *Cystopteris fragilis.* We found few individuals at this site. The species, a biennial, is endemic to Alaska and the adjacent Yukon Territory. In Alaska, it is found in the mountains of southcentral Alaska, north to the Alaska Range and west to the Nulato Hills and Seward Peninsula (Fig. 24d). Although it has been found at an increasing number of sites in the alpine, on outcrops and on unstable screes and gravels (Fig. 26a), it is often found in small populations and is rarely common. The nearest populations to ANIA are to the north, at Wide Bay on the Alaska Peninsula, and on Kodiak Island.

Eleocharis kamtschatica (C.A. Mey) Komarov (G4 S2S3)

Eleocharis kamtschatica (Kamchatka spike rush) was found in wet meadows at three locations near Aniakchak Bay. The first was in a low herbaceous meadow in an old pond bottom, 2.5 km (1.6 mi.) southwest of the mouth of the Aniakchak River (56.76677 °N, 157.53722 °W; elev. 5 m), where it was common and growing with *Eriophorum angustifolium, Rubus stellatus,* and *Spiranthes romanzoffia.* The second was in a wet sedge-*Empetrum* meadow above Aniakchak Bay at the mouth of a small stream, approximately 2.5 km (1.6 mi.) southeast of the mouth of Aniakchak River (56.75779 °N; 157.45923 °W; elev. 5 m), where it was also common and growing with *Menyanthes trifoliata.* The third was in a wet sedge meadow at the north end of Black Creek Lagoon (56.72731 °N, 157.58920 °W; elev. 0 m), where it was found scattered with *Carex lyngbyeai, C. ramenskii,* and *C. mackenziei.*

Recent treatments of this genus (Smith et al. 2002) suggest that there may be several different taxa grouped within this broadly defined species. As currently treated, it is a widespread circumpolar species and is known from approximately 40 sites in Alaska, where it is found in wet (often brackish) meadows, usually near the coast (Fig. 25a). In Asia it is often found inland. If the Alaskan material does consist of two or more taxa, each would have a more restricted distribution and may merit additional consideration as a species of conservation concern.

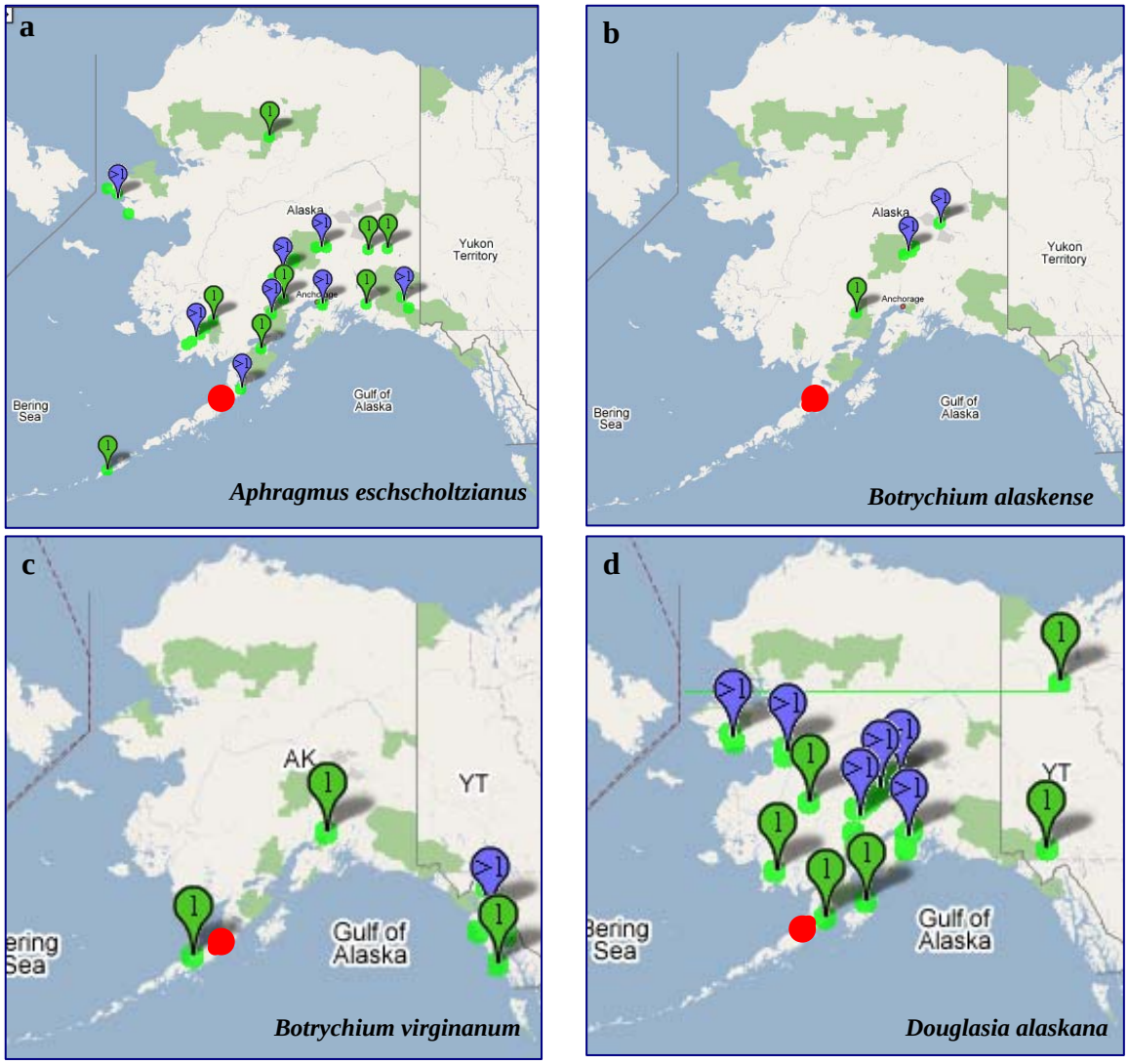

Figure 24. Distribution of (a) *Aphragmus eschscholtzianus*, (b) *Botrychium alaskense*, (c) *B. virginanum*, and (d) *Douglasia alaskanum* in Alaska and the Yukon. Collections in ANIA are indicated in red. Data from ARCTOS, accessed 29 January 2007.

Limosella aquatica L. (G5 S3)

Limosella aquatica (water mudwort) is a diminutive plant found in wet sand and mud with a broad circumpolar distribution (Fig. 26b). In Alaska, it is found at fewer than 20 scattered sites, but is often common where found (Fig. 25b). It is easily overlooked and possibly more common than the known collections indicate. We found it at two sites in ANIA. The first was at the inlet of Surprise Lake, in the Caldera (56.93219 °N; 158.12039 °W; elev. 330 m), where it was common and growing in wet sand on a sparsely vegetated sand bar with *Callitriche anceps*, *Montia fontana*, and *Koenigia islandica*. The second site was near the coast, 2 km (1.2 mi.) upstream from the mouth of the Aniakchak River (56.76681 °N, 157.52675 °W; elev. 5 m), on a sparsely vegetated

wet sand bar with *Deschampisia cespitosa, Hordeum brachyantherum, Equisetum arvense,* and *Koenigia islandica.*

Orobanche uniflora L. (G5 S2)

Orobanche uniflora (single-flowered broomrape) is a North American species widely distributed across much of the United States and Canada, but with a very narrow range in Alaska, where it is known from fewer than ten sites in the south coastal region (Fig. 25c). These sites include Afognak Island, the Semidi Islands (approximately 85 km/55 mi. southeast of ANIA), and the Shumagin Islands to the south (approximately 220 km/140 mi. southwest of ANIA). The ANIA location is well within this range and, although more sites are likely to be found, *O. uniflora* appears to be a fairly narrow endemic, unlikely to prove widespread or common. This species is known to be a root parasite on various herbaceous species; in Alaska, it appears to be parasitic on *Solidago* (Fig. 26c).

We made three collections of this broomrape from near the mouth of the Aniakchak River (Fig 27a-b). Two of these were from a ridge approximately 100 m (325 ft.) west of the Packer's Cabin (56.76413 °N, 157.49112 °W; elev. 15 m), in the understory of a forb meadow, growing in one case with *Heracleum maximum, Solidago lepida, Chamerion angustifolium, Geranium erianthum, Equisetum arvense,* and *Achillea boreale*, and nearby (on the same ridge) with *Solidago multiradiata, Cornus suecica, Carex macrochaeta,* and *Cypripedium guttatum.* The third collection was from the understory of a tall forb-umbel meadow on a bluff above the north side of the Aniakchak River, 2.5 km (1.6 mi.) upstream from the Bay (56.76776 °N, 157.51038 °W; elev. 45 m), growing with *Heracleum maximum, Solidago lepida, Rubus spectabilis, Calamagrostis canadensis*, and *Equisetum arvense.* At this last site it was clearly parasitic on the roots of the *Solidago.* The *Orobanche* was common on both of the tall umbel sites with *Solidago lepida,* and occasional on the medium forb meadow with *Solidago multiradiata.*

Phyllospadix serrulatus Rupr. ex Aschers. (G4 S2)

Phyllospadix serrulatus (toothed surfgrass) was locally common, growing with *Fucus* spp. and other macro-algae, in a rocky tidepool, approximately 1 km (0.6 mi.) east of the mouth of the Aniakchak River (56.76332 °N, 157.47533 °W; elev. 0 m). It is unclear what the true distribution of this species is in Alaska, since surfgrass species tend to be undercollected. Although common globally, where it is found along the Pacific Coast from Baja Mexico north to British Columbia, fewer than 15 locations are known for this species in Alaska, ranging from Southeast Alaska to the Kodiak archipelago (Fig. 25d). This species is easily confused with *Phyllospadix scouleri,* which is more common in southeast Alaska. Eelgrass (*Zostera marina*) is superficially similar to and sometimes mistaken for surf-grass, but grows in lower energy areas with silts and sands, rather than the high energy beaches that surfgrass colonizes (Fig. 27c).

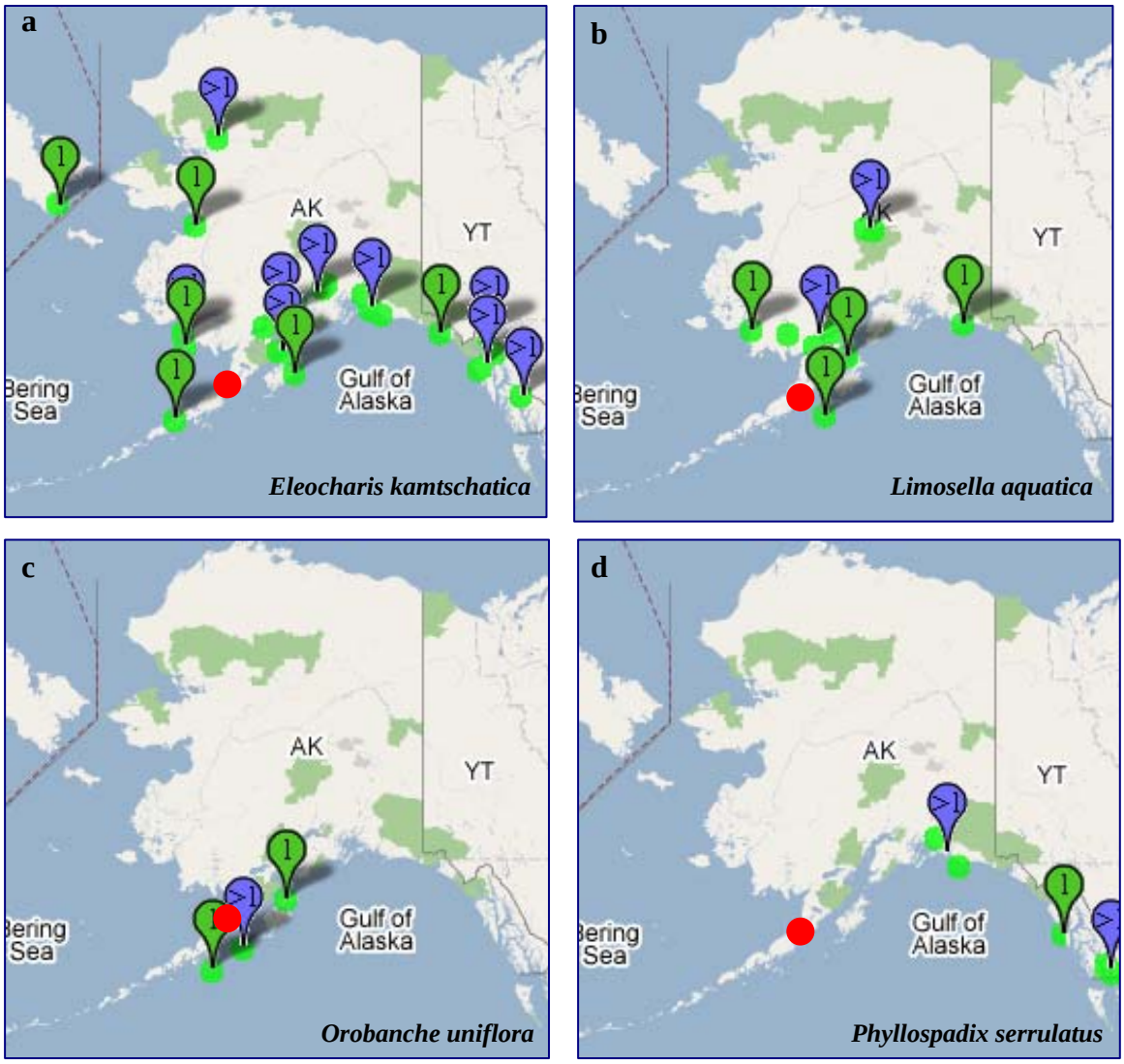

Figure 25. Distribution of (a) *Eleocharis kamtschatica*, (b) *Limosella aquatica*, (c) *Orobanche uniflora*, and (d) *Phyllospadix serrulatus* in Alaska and the Yukon. Collections in ANIA are indicated in red. Data from ARCTOS, accessed 29 January 2007.

Plagiobothrys orientalis (L.) I.M. Johnston (G3G4 S3)

Plagiobothrys orientalis (Oriental popcornflower) is known from scattered freshwater wetlands sites in southcoastal Alaska, and extending to Kamchatka and the Commander Islands in the Russian Far East (Figs. 26d, 29a). Of its Alaskan locations, fewer than 15 are outside of the Aleutian Islands. We collected this species at one site on the wet sand and silty mud of a sandbar island, 2 km (1.2 mi.) upstream from the mouth of the Aniakchak River (56.76681 °N, 157.52675 °W; elev. 5 m). It was flowering and growing in scattered patches with *Deschampsia cespitosa*, *Hordeum brachyantherum*, *Equistum arvense*, and *Koenigia islandica*. This species had previously been collected in ANIA in 1993, in wet sand by Meshik Lake (Hasselbach 1995).

Figure 26. (a) *Douglasia alaskana*, (b) *Limosella aquatica*, (c) *Orobanche uniflora*, and (d) *Plagiobothrys orientalis*.

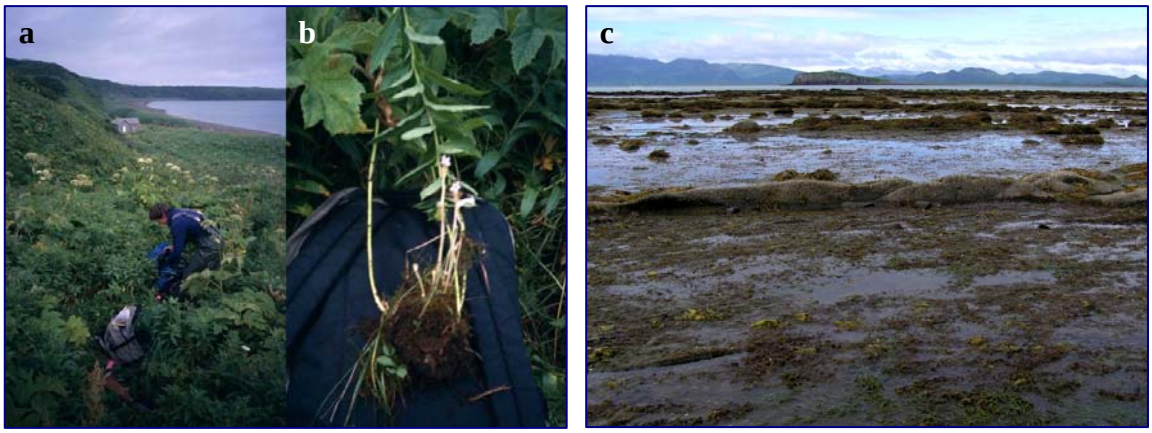

Figure 27. (a) Mesic forb meadow on coastal bluffs supports *Orobanche uniflora*. (b) *O. uniflora* associated with *Solidago lepida*. (c) Intertidal areas support *Phyllospadix serrulatus* in higher energy, wave-impacted areas, and *Zostera marina* in lower-energy, deposition areas.

Polemonium cf. boreale var. *villosissimum* (GU SU – status unknown)

Prior to the 2004 ANIA inventory, several collections of an unusual white-flowered *Polemonium* had been made in the Aniakchak Caldera (Bosworth 1987, Hasselbach 1995). These plants, while clearly related to *P. boreale* var. *villosissimum* Hultén, seemed to differ in flower color, morphology and plant habit (Fig. 28a) and it was thought they might represent a different taxon (D.F.Murray, 2003, *pers. comm.*). During the 2004 inventory we made careful notes on the distribution and abundance of these plants and collected a large series for detailed examination. All individuals of this taxon were inside the Caldera, where they appeared to be relatively common. We did not find any similar individuals outside of the Caldera.

Within the Caldera, this white-flowered Jacob's ladder was found on sparsely vegetated ash and lapilli deposits in many areas except those subject to highest wind scouring. Sites were generally on slopes of 15 to 30 degrees, with variable aspect, although usually not south or southeast facing. The largest populations were found on the northeast side of Vent Mountain (56.90370 °N, 158.13367 °W; elev. 475 m) and the west side of Vulcan Dome (56.93063 °N, 158.13525 °W; elev. 365 m; Fig. 28b), both at the north end of Surprise Lake. Using one-meter belt transects, we estimated the Vulcan Dome population to be approximately 20,000 ramets. We did not set up transects on Vent Mountain, but the population was clearly larger than the one on Vulcan Dome. The population within the Caldera is well over 50,000 ramets and faces no apparent threats other than natural risks due to instability, wind deflation, and vulcanism.

The indentity of these plants remains unclear, but some of the distinctions from the original collections of *P. boreale* var. *villosissimum,* including habit and petal morphology, are no longer evident with a larger series of specimens. The petals of plants collected in 2004 were consistently white with yellow bases and showed no trace of blue, except on one individual. While this does contrast with other specimens of var. *villosissimum,* several earlier collections from the Caldera do show petals with a distinct bluish tinge. At this point, pending further morphological and/or molecular analyses, the

material from ANIA should be treated as a white-flowered form of *P. boreale* var. *villosissimum* (Figure 29b). Why this taxon, so abundant within the Caldera, is not found on the slopes and ash deposits outside of the Caldera remains puzzling.

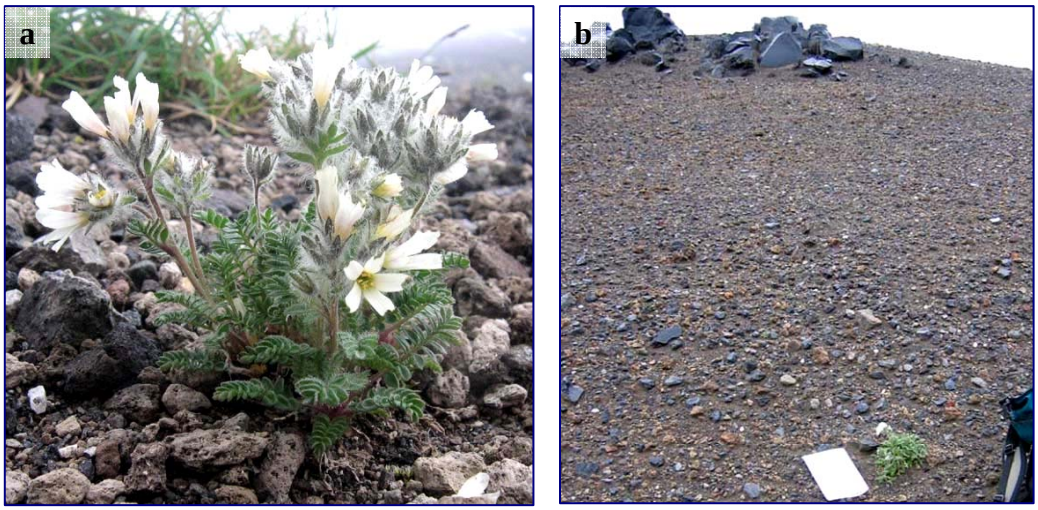

Figure 28. (a) *Polemonium* cf. *boreale* var. *villosissimum*, in Aniakchak Caldera. (b) Polemonium population on Vulcan Dome, Aniakchak Caldera.

Rumex beringensis Jurtzev & Petrovsky (G3 S3)

Most of the Alaskan material treated as *Rumex graminifolius* by Hultén (1968) and others has since been shown to be at least three distinct species, *R. beringensis*, *R. graminifolius*, and *R. krausei*. When *R. beringensis* and *R. krausei* were first described, they were both considered to be rare in Alaska. In contrast, *R. graminifolius* was thought to be the commonly occurring form of this species complex. It now appears *R. graminifolius* is only known from a few sites in northern Alaska. Material from northwest Alaska that had been called *R. graminifolius* is nearly always *R. krausei*. Material from southern Alaska, including collections from ANIA and the Alaska Peninsula, is now treated as *R. beringensis.*

While no longer as rare as we first thought, *R. beringensis* (Bering Sea dock) is still known from fewer than 30 locations in Alaska, and fewer than 50 sites worldwide. *Rumex beringensis* is endemic to southern Alaska and eastern Chukotka, with recent reports from the Yukon Territory (Fig. 29c). It can be locally common on sand and ash deposits, and in ANIA we collected this species at five sites (see Appendix II for locations) and noted its presence at several others in the Meshik River Lowlands. Most of the sites were on the ash deposits and cinder flats of the slopes and lowlands outside the Caldera, but it was also seen at several sites within the Caldera.

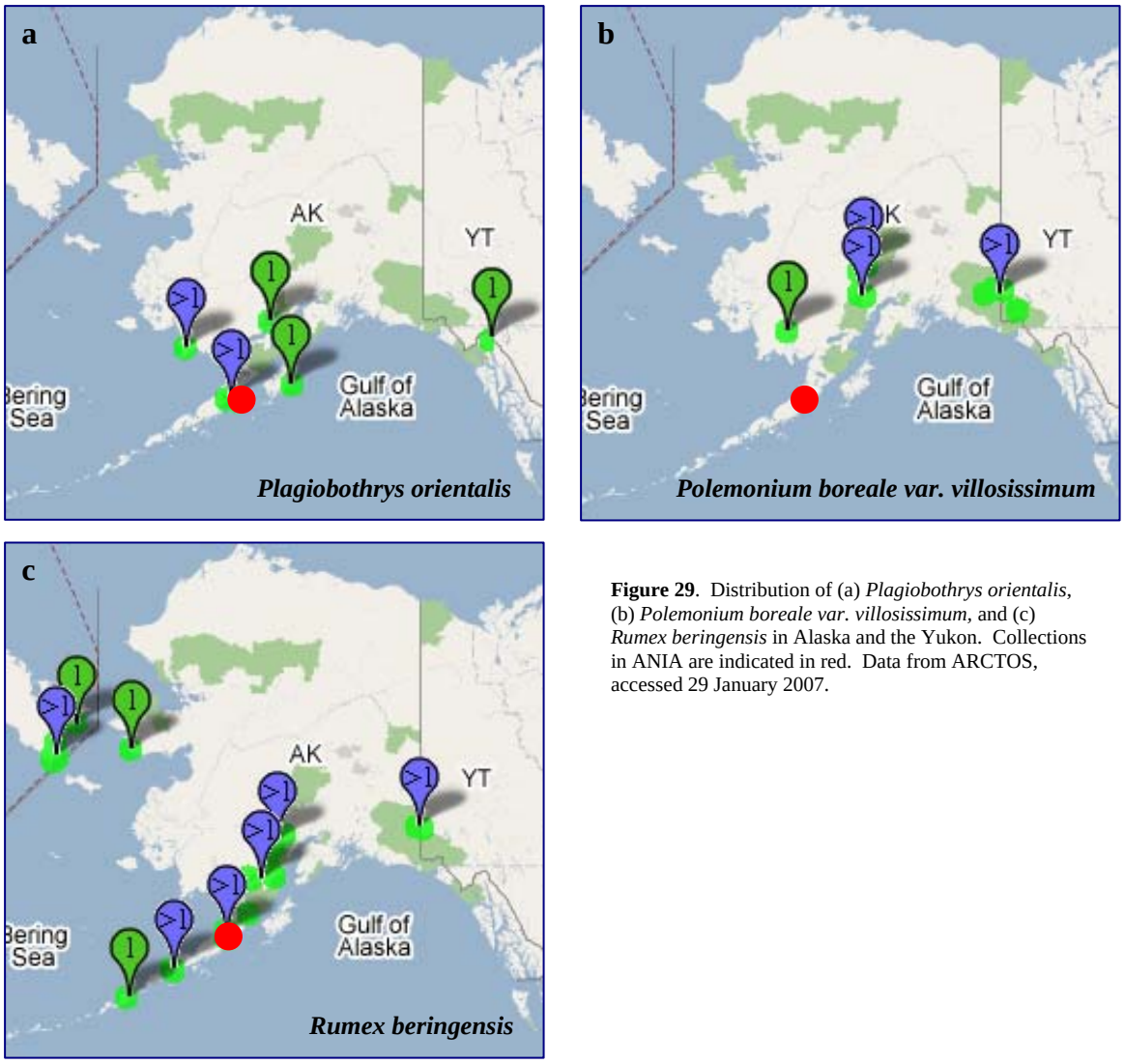

Figure 29. Distribution of (a) *Plagiobothrys orientalis*, (b) *Polemonium boreale var. villosissimum*, and (c) *Rumex beringensis* in Alaska and the Yukon. Collections in ANIA are indicated in red. Data from ARCTOS, accessed 29 January 2007.

Range Extensions

Our collections clarified the distribution patterns of a number of species. In some cases, they filled a gap in previously known collections from further west on the Alaska Peninsula and collections from Kodiak or KATM to the northeast.

For example, *Dupontia fisheri* ssp. *psilosantha* had long been considered a species of arctic coastal tundra, extending south to Cold Bay. Investigations at KATM in 2002 extended the known range of the subspecies to wetlands at the forest's edge near Swikshak Lagoon. Our collection at ANIA fills in the gap between Cold Bay to the west and Swikshak to the east (Fig. 30c). Nine of our 2004 collections represent significant extensions of the known range for the taxa. Appendix II lists collection locations for all species.

Botrychium alaskense: Previously considered a species of interior AK, the collections in ANIA represent a range extension to the southwest from the nearest collections in the Telaquana Badlands, LACL (Fig. 24b). Although not indicated on the map, it is now also known from Southeast Alaska (C. Parker, 2006, *pers. comm.*). Five collections from the Meshik River Lowlands and Aniakchak Caldera were made in ANIA.

Botrychium pedunculosum: A new record for AK. The nearest known populations are in southwest British Columbia (Fig. 23). A single collection from ANIA was made near Waterfall Creek, Meshik River Lowlands.

Carex vaginata Tausch – sheathed sedge: The collections from ANIA represent a range extension to the south from the nearest collection on the southern boundary of LACL, on a ridge south of Lower Tazimina Lake (Fig. 30a). The species is reported from tundra, gravelly slopes and gently sloping till plains (e.g., with ericaceous shrubs and/or *Dryas*), and poorly drained silt or till. The two collections in ANIA were taken from the Garden Wall area (56.79570 °N, 158.04933 °W; 56.18650 °N, 158.04874 °W; elev. 340 m).

Draba macounii Schulz – Macoun's draba: The collection from ANIA represents a range extension to the southwest from the Neacola Mountains/Upper Twin Lake area in LACL (Fig. 30b). The species is reported from alpine areas, in barren tundra, fellfield, and glacial till. Our collection from ANIA was from limestone scree near the Gates (56.90313 °N, 158.07821 °W; elev. 400 m), Aniakchak Caldera, at the same site as our collection of *Aphragmus eschscholtzianus*.

Dupontia fisheri R. Br. **ssp. *psilosantha*** (Rupr.) Hultén – Fisher's tundra grass: Our collections from ANIA serve as range fillers between Cold Bay and Swikshak Lagoon, KATM (Fig. 30c). The species is reported from moist to wet tussock tundra and in ANIA was found at three locations in drained ponds and alluvial deposits in the Meshik River Lowlands (56.75738 °N, 158.08600 °W; 56.74518 °N, 158.07758 °W; elev. 30-35 m) and Coastal Lowlands (56.72731 °N, 157.58920 °W; elev. 0 m), near Black Creek Lagoon.

Hierochloe pauciflora R. Br. – arctic sweetgrass: The collections in ANIA represent a range extension to the south from the nearest collections at Naknek, west of KATM (Fig. 30d). The species is reported from bogs, wet sedge meadows, and wet lake and pond margins. In ANIA, it was collected in the wet meadows at the north end of Black Creek Lagoon (56.72731 °N, 157.58920 °W; elev. 0 m), Aniakchak Coast.

Isoetes echinospora Durieu – spring quillwort: Our collections from ANIA represent a range extension to the southwest from the nearest known collections north of Contact Creek, KATM (Fig. 31a). In ANIA, it was found at one location in a late-successional pond-meadow system south of the Aniakchak River, Meshik River Lowlands (56.76677 °N, 157.53722 °W, elev. 1 m).

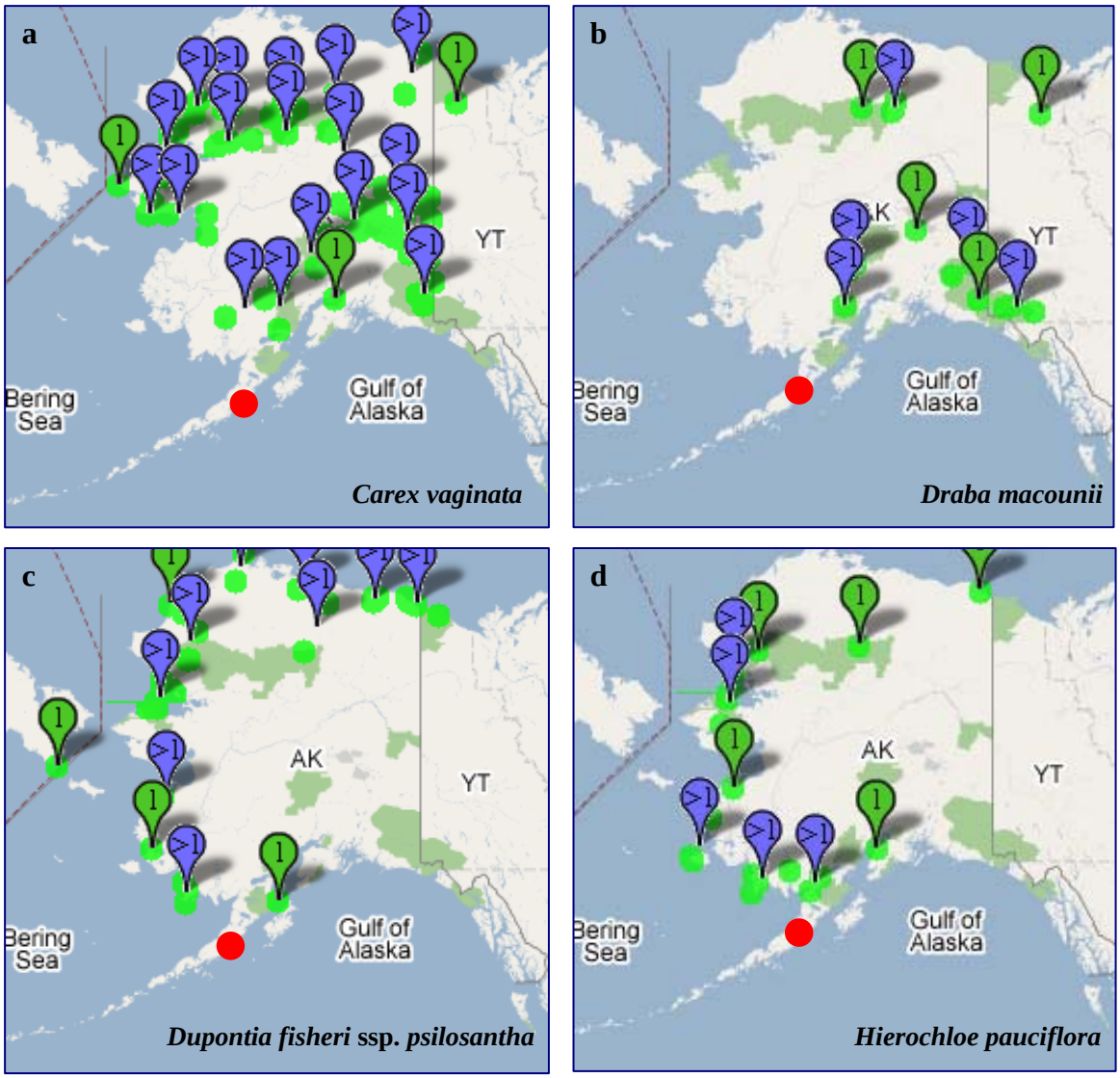

Figure 30. Distribution of (a) *Carex vaginata*, (b) *Draba macounii*, (c) *Dupontia fisheri* ssp. *psilosantha*, and (d) *Hierochloe pauciflora* in Alaska and the Yukon. Collections in ANIA are indicated in red. Data from ARCTOS, accessed 29 January 2007.

Minuartia biflora (L.) Schinz & Thellung – mountain stitchwort: Our collections from ANIA represent a range extension to the south from Cape Pierce and southwest from the Barren Hills, LACL (Fig. 31b). The species is known from alpine habitats, including rocky tundra, boulder fields, and solifluction lobes. The single collection in ANIA was from the Garden Wall (56.80682 °N, 158.04929 °W, elev. 335 m).

Ranunculus abortivus L. – early wood buttercup: Our collections represent a range extension to the southwest from Swikshak Lagoon, KATM (Fig. 31c). The species is recorded from moist areas, including coastal meadows. The collection in ANIA was from a riparian area near Waterfall Creek, Meshik River Lowlands (56.78250 °N, 158.10878 °W, elev. 80 m).

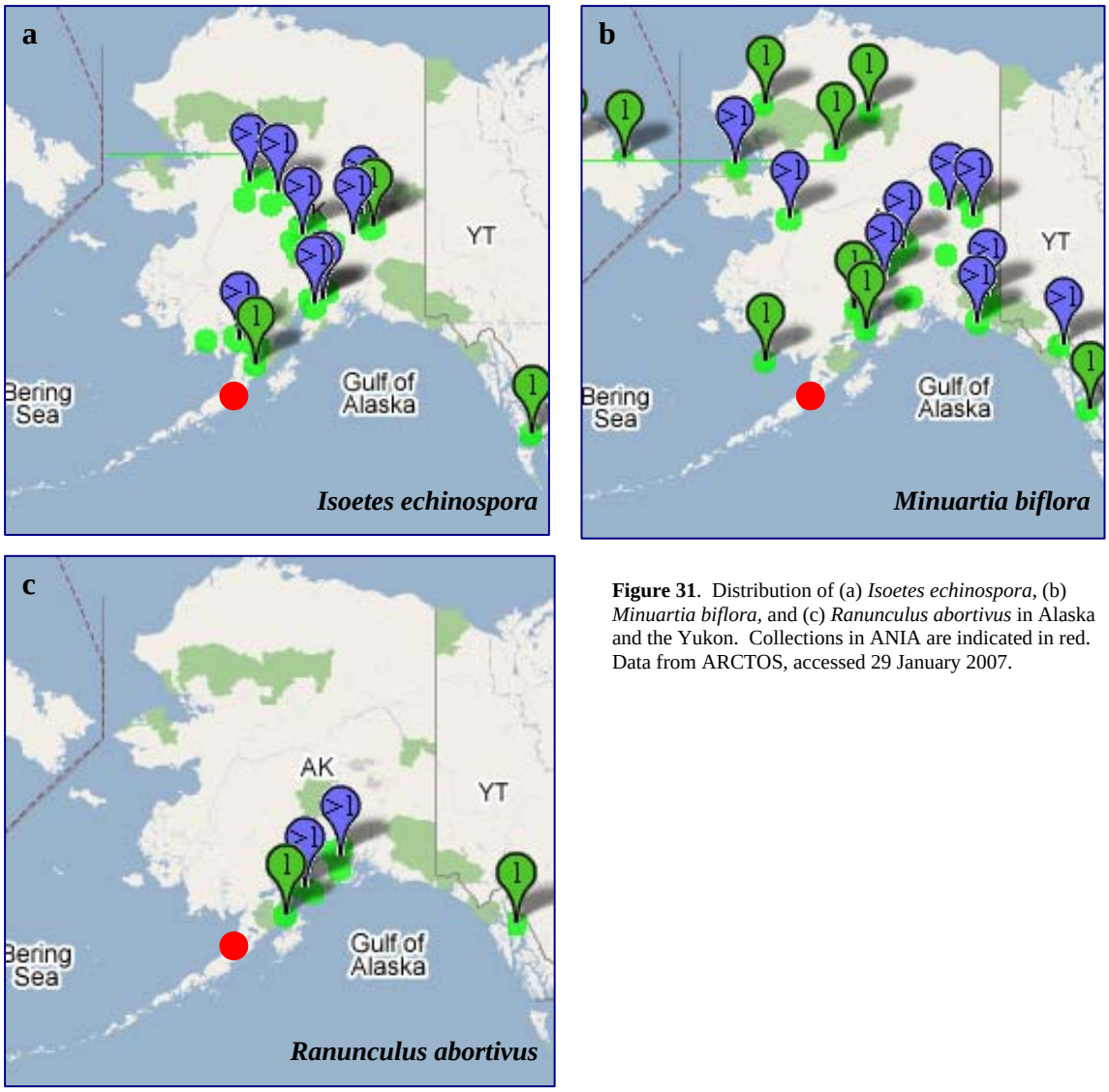

Figure 31. Distribution of (a) *Isoetes echinospora*, (b) *Minuartia biflora*, and (c) *Ranunculus abortivus* in Alaska and the Yukon. Collections in ANIA are indicated in red. Data from ARCTOS, accessed 29 January 2007.

RECOMMENDATIONS

We found no exotic plant species in ANIA, and found little evidence of human activity in the areas that we surveyed. While ATV use out of Port Heiden could affect plant communities to the west of ANIA, most traffic is stopped from entering the park by dense stands of alder. Visitation in ANIA has typically been <100 individuals per year, so we do not anticipate any new threats to the existing populations of rare taxa, many of which are in relatively inaccessible areas of the park. Lichen communities in the Caldera have been identified as potentially susceptible to trampling (Hasselbach 1995), but we did not observe visible damage in the areas that we surveyed.

Anecdotal accounts suggest that alder expansion in low and mid-elevation areas of the park has been rapid in recent years (e.g., J. Klutsch, pers. comm.), as in many other parts

of the Alaska Peninsula. It is possible that alder could establish in some open areas (e.g., ridgelines, cinder barrens) that currently support rare species, but high winds on exposed ridges may slow its increase, at least at higher elevations. A few rare species (e.g., *Botrychium pedunculosum, B. virginianum*) were found in the alder understory, and it is likely that these species, at least, will not be adversely impacted by continued alder expansion.

We recommend that future floristic work in ANIA include the following:

- Collection of additional specimens of *Botrychium pedunculosum* for molecular analysis; i.e., to determine whether the ANIA population shows evidence of prolonged isolation, and/or is genetically distinct from the nearest populations in British Columbia.
- Further morphological study of the *Polemonium* collected from the Caldera. Molecular analyses are recommended on this variant to determine whether it is genetically distinct from populations of *P. boreale* var. *villosissimum* in the Interior.
- Surveys of the northeastern quadrant of ANIA, including highlands and ridges in the Northern Aleutian Mountians Subsection, and the lower Cinder River-Pumice Creek area. While we surveyed a number of cinder flats and blowouts on the south side of ANIA, as well as riparian areas in the Meshik River Lowlands, we likely undersampled riparian areas that cut through more recent volcanic deposits.
- Additional surveys of limestone outcrops and other unusual geologic features.
- Additional surveys of coastal wetlands north of Aniakchak Bay.

ACKNOWLEDGEMENTS

The AKNHP is grateful for the logistical and financial support of the NPS, and in particular to Sara Wesser, Regional I&M Coordinator; Alan Bennett, SWAN Coordinator; and SWAN staff, William Leacock and Amy Miller. Joe Klutsch allowed us to use his Meshik Camp near Rainbow Creek, and provided invaluable information on travel routes and possible collection sites. Cecil Schuman of C-Air provided timely flight service. Amy Miller provided valuable comments on earlier versions of this manuscript. I would especially like to acknowledge the excellent assistance and company in the field of Mike Duffy, Koren Bosworth and Amy Miller.

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APPENDIX I

National Park Service Status of Vascular Plants Expected or Documented in Aniakchak National Monument and Preserve, before and after the 2004 inventory. Plants listed as Present in Park are documented with a voucher collection. Plants listed as Probably Present are known from areas within 50 km of the park boundary or otherwise thought likely to occur. Plants listed as No Status had not been considered as likely to occur prior to the 2004 inventory.

Accepted Name	Park Status 2004	Park Status 2003
Achillea borealis	Present in Park	Present in Park
Aconitum delphiniifolium	Present in Park	Present in Park
Actaea rubra	Present in Park	Probably Present
Agrostis alaskana	Present in Park	Present in Park
Agrostis mertensii	Present in Park	Present in Park
Agrostis scabra Willd.	Present in Park	Present in Park
Allium schoenoprasum	Present in Park	No Status
Alnus crispa (Ait.) Pursh ssp. sinuata	Present in Park	Present in Park
Alopecurus aequalis	Present in Park	No Status
Alopecurus alpinus	Present in Park	No Status
Andromeda polifolia	Present in Park	Probably Present
Androsace chamaejasme Host ssp. Lehmanniana	Present in Park	Present in Park
Anemone narcissiflora ssp. villosissima	Present in Park	Probably Present
Anemone parviflora	Present in Park	Probably Present
Anemone richardsonii	Present in Park	Probably Present
Angelica genuflexa	Present in Park	Present in Park
Angelica lucida	Present in Park	No Status
Antennaria alpina	Present in Park	Present in Park
Antennaria friesiana	Present in Park	No Status
Antennaria monocephala DC. ssp. monocephala	Present in Park	Present in Park
Antennaria pallida E.Nels.	Present in Park	Present in Park
Aphragmus eschscholtzianus	Present in Park	No Status
Arabis hirsuta var. eschscholtziana	Present in Park	No Status
Arabis kamchatica	Present in Park	Present in Park
Arabis lemmoni S.Wats.	Present in Park	Present in Park
Arabis media	Present in Park	No Status
Arctagrostis latifolia var. arundinacea	Present in Park	Present in Park
Arctophila fulva	Present in Park	Probably Present
Arctostaphylos uva-ursi	Present in Park	No Status
Argentina egedii ssp. egedii	Probably Present	Probably Present
Argentina egedii ssp. grandis	Present in Park	No Status
Armeria maritima (Mill.) Willd. ssp. arctica	Present in Park	Present in Park
Arnica amplexicaulis	Present in Park	No Status
Arnica Chamissonis Less. ssp. Chamissonis	Present in Park	Present in Park

Arnica Lessingii	Present in Park	Present in Park
Artemisia alaskana	Present in Park	Present in Park
Artemisia arctica ssp. arctica	Present in Park	Present in Park
Artemisia borealis	Present in Park	Present in Park
Artemisia globularia	Present in Park	Present in Park
Artemisia tilesii	Present in Park	Present in Park
Aster sibiricus	Present in Park	Present in Park
Astragalus alpinus ssp. alpinus	Present in Park	Present in Park
Astragalus umbellatus	Present in Park	Probably Present
Athyrium filix-femina ssp. cyclosorum	Present in Park	Present in Park
Atriplex alaskensis	Present in Park	Present in Park
Atriplex gmelini	Present in Park	Present in Park
Barbarea orthoceras	Present in Park	Probably Present
Betula nana	Present in Park	Probably Present
Boschniakia rossica	Present in Park	No Status
Botrychium alaskanense	Present in Park	No Status
Botrychium lanceolatum	Present in Park	Present in Park
Botrychium lunaria	Present in Park	Present in Park
Botrychium minganense	Present in Park	No Status
Botrychium pedunculosum	Present in Park	No Status
Botrychium pinnatum	Present in Park	Present in Park
Botrychium virginianum	Present in Park	No Status
Bromus ciliatus	Present in Park	Present in Park
Bupleurum triradiatum	Probably Present	Probably Present
Cakile edentula	Present in Park	Present in Park
Calamagrostis canadensis	Present in Park	Present in Park
Calamagrostis deschampsioides	Present in Park	Present in Park
Calamagrostis stricta ssp. inexpansa	Present in Park	No Status
Calamagrostis stricta ssp. stricta	Present in Park	No Status
Calamagrostis lapponica	Present in Park	No Status
Callitriche palustris	Present in Park	No Status
Caltha palustris ssp. arctica	Present in Park	Present in Park
Campanula lasiocarpa	Present in Park	Present in Park
Cardamine bellidifolia	Present in Park	Present in Park
Cardamine pratensis	Present in Park	Probably Present
Cardamine umbellata	Present in Park	Present in Park
Carex anthoxanthea	Present in Park	No Status
Carex aquatilis ssp. aquatilis	Present in Park	Present in Park
Carex bicolor	Present in Park	No Status
Carex Bigelowii	Present in Park	Present in Park
Carex canescens	Present in Park	No Status
Carex capillaris	Present in Park	Probably Present
Carex chordorrhiza	Present in Park	Probably Present

Carex circinnata	Present in Park	Present in Park
Carex disperma	Present in Park	Probably Present
Carex enanderi	Present in Park	No Status
Carex glareosa ssp. glareosa	Present in Park	Present in Park
Carex gmelini	Present in Park	Present in Park
Carex gynocrates	Present in Park	Probably Present
Carex kelloggii	Present in Park	Present in Park
Carex lachenalii	Present in Park	No Status
Carex laeviculmis	Present in Park	No Status
Carex limosa	Present in Park	Present in Park
Carex livida	Present in Park	Present in Park
Carex Lyngbyaei	Present in Park	Present in Park
Carex mackenziei	Present in Park	No Status
Carex macrocephala	Present in Park	Present in Park
Carex macrochaeta	Present in Park	Present in Park
Carex media	Present in Park	Present in Park
Carex microchaeta ssp. nesophila	Present in Park	Present in Park
Carex micropoda	Present in Park	Present in Park
Carex nigricans	Present in Park	No Status
Carex pachystachya	Present in Park	Probably Present
Carex pluriflora	Present in Park	Present in Park
Carex ramenskii	Present in Park	No Status
Carex rariflora	Present in Park	Present in Park
Carex saxatilis	Present in Park	No Status
Carex scirpoidea	Present in Park	No Status
Carex stylosa	Present in Park	No Status
Carex tenuiflora	Present in Park	Present in Park
Carex vaginata	Present in Park	No Status
Carex williamsii	Present in Park	Probably Present
Cassiope lycopodioides	Present in Park	Present in Park
Cassiope mertensiana	Present in Park	Probably Present
Cassiope Stelleriana	Present in Park	Present in Park
Castilleja unalaschensis	Present in Park	Probably Present
Cerastium Beeringianum	Present in Park	Present in Park
Chrysanthemum arcticum ssp. arcticum	Present in Park	Present in Park
Chrysanthemum bipinnatum	Present in Park	Present in Park
Chrysosplenium tetrandrum	Present in Park	No Status
Chrysosplenium wrightii	Present in Park	Present in Park
Cicuta virosa	Present in Park	No Status
Circaea alpina	Present in Park	Present in Park
Claytonia chamissoi	Present in Park	No Status
Claytonia sarmentosa	Present in Park	No Status
Claytonia sibirica	Present in Park	No Status

Cochlearia officinalis	Present in Park	Probably Present
Coeloglossum viride ssp. bracteatum	Present in Park	Present in Park
Comarum palustre	Present in Park	Present in Park
Conioselinum gmelinii	Present in Park	Present in Park
Corallorhiza trifida	Present in Park	Present in Park
Cornus suecica	Present in Park	Present in Park
Cryptogramma acrostichoides	Present in Park	Present in Park
Cryptogramma crispa	Present in Park	Present in Park
Cypripedium guttatum	Present in Park	Probably Present
Cystopteris fragilis ssp. fragilis	Present in Park	Present in Park
Dactylorhiza aristata	Probably Present	Probably Present
Deschampsia beringensis	Present in Park	Present in Park
Deschampsia caespitosa	Present in Park	Present in Park
Deschampsia cespitosa ssp. orientalis	Present in Park	Present in Park
Diapensia lapponica ssp. obovata	Present in Park	Present in Park
Douglasia alaskana	Present in Park	No Status
Draba alpina	Present in Park	Present in Park
Draba borealis	Present in Park	Present in Park
Draba borealis	Present in Park	Present in Park
Draba lactea	Probably Present	Probably Present
Draba lonchocarpa var. lonchocarpa	Present in Park	Probably Present
Draba macounii	Present in Park	No Status
Draba nivalis	Present in Park	Present in Park
Drosera rotundifolia	Present in Park	No Status
Dryas integrifolia	Present in Park	Probably Present
Dryas octopetala	Present in Park	Present in Park
Dryas octopetala ssp. octopetala	Present in Park	Present in Park
Dupontia fisheri ssp. psilosantha	Present in Park	No Status
Eleocharis kamtschatica	Present in Park	No Status
Elymus trachycaulus ssp. majus	Present in Park	No Status
Empetrum hermaphroditum	Probably Present	Probably Present
Empetrum nigrum	Present in Park	Present in Park
Epilobium anagallidifolium	Present in Park	Present in Park
Epilobium angustifolium	Present in Park	Present in Park
Epilobium behringianum	Present in Park	Present in Park
Epilobium ciliatum ssp. glandulosum	Present in Park	Present in Park
Epilobium glandulosum	Present in Park	Present in Park
Epilobium hornemannii	Present in Park	Present in Park
Epilobium latifolium	Present in Park	Present in Park
Epilobium luteum	Present in Park	Present in Park
Epilobium palustre	Present in Park	Probably Present
Equisetum arvense	Present in Park	Probably Present
Equisetum fluviatile	Present in Park	Present in Park

Equisetum hyemale	Probably Present	Probably Present
Equisetum palustre	Present in Park	Present in Park
Equisetum pratense	Present in Park	No Status
Equisetum scirpoides	Present in Park	Probably Present
Equisetum silvaticum	Present in Park	Present in Park
Equisetum variegatum	Present in Park	Present in Park
Erigeron peregrinus ssp. peregrinus	Present in Park	Present in Park
Eriophorum angustifolium ssp. subarcticum	Present in Park	Present in Park
Eriophorum gracile	Present in Park	Probably Present
Eriophorum russeolum	Present in Park	Probably Present
Eriophorum Scheuchzeri	Present in Park	Present in Park
Euphrasia mollis	Present in Park	Present in Park
Festuca altaica	Present in Park	Present in Park
Festuca brachyphylla	Present in Park	Present in Park
Festuca rubra coll.	Present in Park	Present in Park
Festuca rubra ssp. richardsonii	Present in Park	No Status
Fritillaria camschatcensis	Present in Park	Probably Present
Galium aparine	Present in Park	Probably Present
Galium boreale	Present in Park	Present in Park
Galium trifidum ssp. trifidum	Present in Park	Probably Present
Galium triflorum	Present in Park	Probably Present
Gentiana algida	Present in Park	Probably Present
Gentianella amarella	Present in Park	Present in Park
Gentianella propinqua ssp. aleutica	Present in Park	Present in Park
Gentianella propinqua ssp. propinqua	Present in Park	No Status
Gentiana prostrata	Present in Park	No Status
Gentianella tenella	Present in Park	No Status
Geranium erianthum	Present in Park	Present in Park
Geum macrophyllum ssp. macrophyllum	Present in Park	Present in Park
Geum Rossii	Present in Park	Present in Park
Gymnocarpium dryopteris	Present in Park	Probably Present
Heuchera glabra	Present in Park	Present in Park
Hieracium triste	Present in Park	Present in Park
Hierochloe alpina	Present in Park	Present in Park
Hierochloe odorata	Present in Park	Probably Present
Hierochloe pauciflora	Present in Park	No Status
Hippuris montana	Present in Park	No Status
Hippuris tetraphylla	Present in Park	Present in Park
Hippuris vulgaris	Present in Park	Present in Park
Honkenya peploides	Present in Park	Probably Present
Hordeum brachyantherum	Present in Park	Probably Present
Huperzia selago	Present in Park	Present in Park
Iris setosa	Present in Park	Probably Present

Isoetes echinospora	Present in Park	No Status
Juncus alpinus	Present in Park	Present in Park
Juncus arcticus	Present in Park	Present in Park
Juncus biglumis	Present in Park	No Status
Juncus bufonius	Present in Park	No Status
Juncus castaneus ssp. castaneus	Present in Park	Present in Park
Juncus drummondii	Present in Park	Present in Park
Juncus Mertensianus	Present in Park	Present in Park
Juncus triglumis ssp. albescens	Present in Park	Present in Park
Koenigia islandica	Present in Park	Present in Park
Lagotis glauca	Present in Park	Probably Present
Lathyrus maritimus	Present in Park	Probably Present
Lathyrus palustris	Present in Park	Probably Present
Ledum groenlandicum	Probably Present	Probably Present
Ledum palustre ssp. decumbens	Present in Park	Probably Present
Leptarrhena pyrolifolia	Present in Park	Present in Park
Leymus mollis	Present in Park	Present in Park
Ligusticum mutellinoides	Present in Park	No Status
Ligusticum scoticum ssp. Hultenii	Present in Park	Present in Park
Limosella aquatica	Present in Park	No Status
Listera cordata	Present in Park	Present in Park
Lloydia serotina	Present in Park	No Status
Loiseleuria procumbens	Present in Park	Present in Park
Lomatogonium rotatum	Present in Park	No Status
Luetkea pectinata	Present in Park	Present in Park
Lupinus nootkatensis	Present in Park	Present in Park
Luzula arcuata ssp. arcuata	Present in Park	Probably Present
Luzula arcuata ssp. unalaschcensis	Present in Park	Present in Park
Luzula kjellmaniana	Present in Park	No Status
Luzula multiflora	Present in Park	Present in Park
Luzula multiflora ssp. kobayasii	Probably Present	Probably Present
Luzula parviflora	Present in Park	Present in Park
Luzula piperi	Present in Park	Present in Park
Luzula spicata	Present in Park	No Status
Lycopodium alpinum	Present in Park	Present in Park
Lycopodium annotinum ssp. annotinum	Present in Park	Present in Park
Lycopodium clavatum	Present in Park	Present in Park
Lycopodium sabinaefolium	Present in Park	Present in Park
Matricaria discoidea	Probably Present	Probably Present
Menyanthes trifoliata	Present in Park	Present in Park
Mertensia maritima	Present in Park	Probably Present
Mimulus guttatus	Present in Park	Present in Park
Minuartia arctica	Present in Park	Probably Present

Minuartia biflora	Present in Park	No Status
Minuartia macrocarpa	Present in Park	Present in Park
Minuartia rubella	Present in Park	No Status
Mitella pentandra	Probably Present	Probably Present
Moehringia lateriflora	Present in Park	Probably Present
Montia fontana	Present in Park	Present in Park
Myosotis alpestris	Present in Park	Present in Park
Nuphar polysepalum	Probably Present	Probably Present
Orobanche uniflora	Present in Park	No Status
Oxycoccus microcarpus	Present in Park	No Status
Oxyria digyna	Present in Park	Present in Park
Oxytropis bryophila	Present in Park	Probably Present
Oxytropis maydelliana	Present in Park	Probably Present
Oxytropis viscida	Present in Park	Present in Park
Packera cymbalaria	Present in Park	Present in Park
Papaver alaskanum	Present in Park	Present in Park
Parnassia Kotzebuei	Present in Park	Present in Park
Parnassia palustris var. tenuis	Present in Park	Present in Park
Pedicularis capitata	Present in Park	Present in Park
Pedicularis labradorica	Present in Park	Probably Present
Pedicularis lanata	Present in Park	No Status
Pedicularis Langsdorffii ssp. Langsdorffii	Present in Park	Present in Park
Pedicularis pacifica	Present in Park	Present in Park
Pedicularis parviflora	Present in Park	Probably Present
Pedicularis verticillata	Present in Park	Present in Park
Petasites frigidus	Present in Park	Probably Present
Phleum alpinum	Present in Park	Present in Park
Phyllodoce aleutica ssp. aleutica	Present in Park	Present in Park
Phyllospadix serrulatus	Present in Park	No Status
Pinguicula vulgaris	Present in Park	No Status
Plagiobothrys orientalis	Present in Park	Present in Park
Plantago maritima	Present in Park	No Status
Platanthera aquilonis	Present in Park	Present in Park
Platanthera convallariaefolia	Present in Park	Present in Park
Platanthera dilatata	Present in Park	Present in Park
Platanthera dilatata var. chlorantha	Present in Park	Present in Park
Platanthera hyperborea var. viridiflora	Present in Park	Present in Park
Platanthera obtusata	Present in Park	No Status
Platanthera stricta	Present in Park	Present in Park
Poa alpina	Present in Park	Present in Park
Poa arctica	Present in Park	Present in Park
Poa arctica ssp. longiculmis	Present in Park	Present in Park
Poa eminens	Present in Park	Present in Park

Poa glauca	Present in Park	No Status
Poa hispidula	Present in Park	Present in Park
Poa lanata	Present in Park	Present in Park
Poa palustris	Present in Park	Present in Park
Poa paucispicula	Present in Park	Present in Park
Poa pratensis	Present in Park	No Status
Poa pseudoabbreviata	Present in Park	No Status
Poa stenantha	Present in Park	No Status
Polemonium acutiflorum	Present in Park	Present in Park
Polemonium boreale var. villosissimum	Present in Park	Present in Park
Polemonium pulcherrimum	Present in Park	No Status
Polygonium viviparum	Present in Park	Present in Park
Polygonum aviculare	Present in Park	Probably Present
Polypodium vulgare	Present in Park	No Status
Potamogeton alpinus	Present in Park	No Status
Potamogeton filiformis	Present in Park	No Status
Potamogeton pusillus	Present in Park	No Status
Potamogeton richardsonii	Present in Park	Probably Present
Potentilla hyparctica	Present in Park	No Status
Potentilla villosa	Present in Park	Present in Park
Prenanthes alata	Present in Park	No Status
Primula cuneifolia ssp. saxifragifolia	Present in Park	Present in Park
Primula eximia	Present in Park	Probably Present
Puccinellia langeana	Present in Park	No Status
Puccinellia nutkaensis	Present in Park	No Status
Puccinellia phryganodes	Present in Park	No Status
Pyrola asarifolia	Present in Park	Present in Park
Pyrola minor	Present in Park	Present in Park
Pyrola secunda ssp. secunda	Present in Park	Present in Park
Ranunculus abortivus	Present in Park	No Status
Ranunculus eschscholtzii	Present in Park	Present in Park
Ranunculus gelidus	Present in Park	No Status
Ranunculus hyperboreus ssp. hyperboreus	Present in Park	Present in Park
Ranunculus occidentalis	Probably Present	Probably Present
Ranunculus pallasii	Present in Park	Probably Present
Ranunculus reptans	Present in Park	No Status
Ranunculus trichophyllus var. trichophyllus	Present in Park	Present in Park
Rhinanthus minor ssp. borealis	Present in Park	Present in Park
Rhodiola integrifolia	Present in Park	Present in Park
Rhododendron camtschaticum	Present in Park	Present in Park
Romanzoffia unalaschcensis	Present in Park	Present in Park
Rorippa palustris	Present in Park	Probably Present
Rubus chamaemorus	Present in Park	Probably Present

Rubus spectabilis	Present in Park	No Status
Rubus stellatus	Present in Park	Present in Park
Rumex acetosella	Probably Present	Probably Present
Rumex arcticus	Present in Park	Probably Present
Rumex beringensis	Present in Park	Present in Park
Rumex fenestratus	Present in Park	Present in Park
Ruppia maritima var. spiralis	Present in Park	No Status
Sagina maxima ssp. crassicaulis	Present in Park	No Status
Sagina nivalis	Present in Park	Present in Park
Salix alaxensis	Present in Park	Present in Park
Salix arbusculoides	Present in Park	Present in Park
Salix arctica ssp. crassijulis	Present in Park	Present in Park
Salix Barclayi	Present in Park	Present in Park
Salix commutata	Present in Park	No Status
Salix fuscescens	Present in Park	Present in Park
Salix glauca	Present in Park	Present in Park
Salix ovalifolia	Present in Park	Present in Park
Salix phlebophylla	Present in Park	Present in Park
Salix pulchra	Present in Park	Probably Present
Salix reticulata	Present in Park	Present in Park
Salix rotundifolia ssp. rotundifolia	Present in Park	Present in Park
Salix sitchensis	Present in Park	Present in Park
Sambucus racemosa	Present in Park	Probably Present
Sanguisorba stipulata	Present in Park	Present in Park
Saussurea angustifolia	Present in Park	Present in Park
Saxifraga bracteata	Present in Park	Probably Present
Saxifraga bronchialis	Present in Park	Present in Park
Saxifraga calycina ssp. unalaschcensis	Present in Park	Present in Park
Saxifraga cespitosa	Present in Park	Probably Present
Saxifraga eschscholtzii	Present in Park	Present in Park
Saxifraga flagellaris	Present in Park	Present in Park
Saxifraga foliolosa	Present in Park	Present in Park
Saxifraga hirculus	Present in Park	Present in Park
Saxifraga lyallii	Present in Park	Present in Park
Saxifraga nelsoniana	Present in Park	Present in Park
Saxifraga nivalis	Present in Park	Present in Park
Saxifraga oppositifolia ssp. oppositifolia	Present in Park	Present in Park
Saxifraga rivularis	Present in Park	Present in Park
Saxifraga serpyllifolia	Present in Park	Present in Park
Senecio congestus	Present in Park	Present in Park
Senecio pseudoarnica	Present in Park	Present in Park
Senecio triangularis	Present in Park	Present in Park
Sibbaldia procumbens	Present in Park	Present in Park

Silene acaulis	Present in Park	Probably Present
Solidago lepida	Present in Park	Present in Park
Solidago multiradiata var. multiradiata	Present in Park	Present in Park
Sparganium angustifolium	Present in Park	No Status
Sparganium hyperboreum	Present in Park	Present in Park
Spiranthes romanzoffiana	Present in Park	Present in Park
Stellaria calycantha	Present in Park	Present in Park
Stellaria crassifolia	Present in Park	Present in Park
Stellaria crispa	Present in Park	Present in Park
Stellaria humifusa	Present in Park	No Status
Stellaria longipes	Present in Park	No Status
Stellaria monantha	Present in Park	Present in Park
Stellaria ruscifolia ssp. aleutica	Present in Park	Present in Park
Streptopus amplexifolius	Present in Park	No Status
Subularia aquatica	Present in Park	No Status
Swertia perennis	Present in Park	Present in Park
Taraxacum ceratophorum	Present in Park	No Status
Taraxacum kamtschaticum	Present in Park	No Status
Taraxacum trigonolobum	Present in Park	No Status
Tellima grandiflora	Present in Park	Probably Present
Thalictrum alpinum	Present in Park	Present in Park
Thalictrum sparsiflorum	Probably Present	Probably Present
Thelypteris phegopteris	Present in Park	Present in Park
Tofieldia coccinea	Present in Park	Present in Park
Trichophorum cespitosum	Present in Park	Probably Present
Trientalis europaea ssp. arctica	Present in Park	Present in Park
Triglochin maritimum	Present in Park	No Status
Triglochin palustris	Present in Park	Present in Park
Trisetum spicatum	Present in Park	Present in Park
Urtica dioica	Present in Park	No Status
Utricularia intermedia	Probably Present	Probably Present
Utricularia minor	Present in Park	No Status
Utricularia vulgaris ssp. macrorhiza	Probably Present	Probably Present
Vaccinium ovalifolium	Present in Park	Present in Park
Vaccinium uliginosum L. ssp. alpinum	Present in Park	Present in Park
Vaccinium vitis-idaea	Present in Park	Present in Park
Vahlodea atropurpurea ssp. latifolia	Present in Park	Present in Park
Valeriana capitata	Present in Park	Present in Park
Veronica americana	Present in Park	Probably Present
Veronica serpyllifolia ssp. humifusa	Present in Park	Present in Park
Veronica Stelleri	Present in Park	Present in Park
Veronica wormskjoldii	Present in Park	No Status
Viola epipsila	Present in Park	Probably Present

Viola Langsdorffii	Present in Park	Present in Park
Viola selkirkii	Present in Park	No Status
Woodsia ilvensis	Present in Park	Probably Present
Woodsia scopulina	Probably Present	Probably Present
Zostera marina	Present in Park	No Status

APPENDIX II

Plant Collections by Alaska Natural Heritage Program at Aniakchak National Monument and Preserve, 2004

coll #	coll suffix	family	genus	species	infrank	infname	specific location	latitude	longitude
188		Ranunculaceae	Actaea	rubra			Meshik R. drainage, 'Island Hill Lake', on Waterfall Cr.	56.75211	158.12126
382		Ranunculaceae	Actaea	rubra			Packers' Cabin, N side of bay	56.76438	157.48898
10		Poaceae	Agrostis	alaskana			exposed open sand area just N of S-facing cinder ridge, trending E-W, E of Rainbow Cr.	56.77500	158.06410
145		Poaceae	Agrostis	alaskana			Meshik R. drainage, wetlands E of Rainbow Cr., 4 km S of Joe Klutsch's Rainbow Cr. camp	56.73018	158.08046
376		Liliaceae	Allium	schoenoprasum			Packers' Cabin, N side of bay	56.76438	157.48898
162		Poaceae	Alopecurus	aequivalis			Meshik R. drainage, small tributary of Waterfall Cr. N of 'Observation Hill'	56.77518	158.09975
84		Poaceae	Alopecurus	alpinus	ssp.	stejnegeri	small waterfall in subalpine stream feeding into Waterfall Cr., ca. 3 km NW of Joe Klutsch's Rainbow Cr. camp	56.79125	158.13074
149		Poaceae	Alopecurus	alpinus	ssp.	glauca	Meshik R., N side	56.72569	158.07430
202		Poaceae	Alopecurus	alpinus	ssp.	stejnegeri	Meshik R. drainage, headwaters of Waterfall Cr.	56.78659	158.13443
237	A	Poaceae	Alopecurus	alpinus	ssp.	glauca	caldera, rock outcrop on caldera wall, N of 1931 eruption site	56.91200	158.21750
48		Ericaceae	Andromeda	polifolia			Meshik R. drainage, drained pond on alluvial fan, 1.2 km S of Joe Klutsch's Rainbow Cr. camp	56.75738	158.08600
335		Ranunculaceae	Anemone	narcissiflora	ssp.	villosissima	meadow above E side of mouth of small stream emptying into Aniakchak Bay, ca. 2.25 km SE of mouth of Aniakchak R.	56.75580	157.45906
113		Ranunculaceae	Anemone	parviflora			Meshik R. drainage, S side of caldera, The Garden Wall ridge	56.80682	158.04929
78		Ranunculaceae	Anemone	richardsonii			small waterfall in subalpine stream feeding into Waterfall Cr., ca. 3 km NW of Joe Klutsch's Rainbow Cr. camp	56.79125	158.13074
216		Apiaceae	Angelica	lucida			Rainbow Cr., 200 m N of Joe Klutsch's camp	56.77289	158.08360
100		Asteraceae	Antennaria	alpina			S side of caldera, rock outcrop below S summit of The Garden Wall ridge	56.79570	158.04933
12		Asteraceae	Antennaria	friesiana			raised terrace E of W fork of upper Cub Cr.	56.77671	158.06400
259		Brassicaceae	Aphragmus	eschscholtzianus			caldera, limestone scree slopes on S side of 'The Gates'	56.90313	158.07821
28		Brassicaceae	Arabis	hirsuta	var.	eschscholtziana	shoulder of The Garden Wall ridge, 20m above terrace	56.78217	158.06171
8		Brassicaceae	Arabis	media			exposed open sand area just N of S-facing cinder ridge, trending E-W, E of Rainbow Cr.	56.77500	158.06410
219		Brassicaceae	Arabis	media			Rainbow Cr., 200 m N of Joe Klutsch's camp	56.77289	158.08360
83		Poaceae	Arctagrostis	latifolia	var.	arundinacea	small waterfall in subalpine stream feeding into Waterfall Cr., ca. 3 km NW of Joe Klutsch's Rainbow Cr. camp	56.79125	158.13074
214		Poaceae	Arctagrostis	latifolia	var.	arundinacea	Rainbow Cr., 200 m N of Joe Klutsch's camp	56.77289	158.08360
158		Poaceae	Arctophila	fulva			Meshik R., N side	56.72569	158.07430
6		Ericaceae	Arctostaphylos	uva-ursi			S-facing cinder ridge, trending E-W, E of Rainbow Cr.	56.77553	158.06387
283		Rosaceae	Argentina	egedii			midstream rocky island ca. 1 km upstream of the mouth of Aniakchak R.	56.76445	157.50819

352	Rosaceae	Argentina	egedii	ssp. grandis	NE corner of Black Creek Lagoon, at mouth of creek in the old Aniakchak riverbed	56.72633	157.57977
380	Asteraceae	Arnica	amplexicaulis		bluff above N side of mouth of Aniakchak R., 2 km from the bay	56.76776	157.51038
223	Asteraceae	Artemisia	borealis		exposed ash flats E of Joe Klutsch's Rainbow Cr. camp	56.76714	158.06151
327	Fabaceae	Astragalus	umbellatus		ridge 100 m W of Packers' Cabin at mouth of Aniakchak R., just above outhouse	56.76366	157.49141
291	Chenopodiaceae	Atriplex	gmelinii		long beach SW of mouth of Aniakchak R.	56.76107	157.51349
155	Brassicaceae	Barbarea	orthoceras		Meshik R., N side	56.72569	158.07430
67	Betulaceae	Betula	nana		Meshik R. drainage, drained pond on alluvial fan, 1.2 km S of Joe Klutsch's Rainbow Cr. camp	56.75738	158.08600
312	Polygonaceae	Bistorta	vivipara		W bank of Aniakchak R., ca. 1.5 km from the mouth	56.76317	157.51254
378	Orobanchaceae	Boschniakia	rossica		mouth of Aniakchak R., NE side, ca. 1 km from the bay	56.76611	157.50545
3 B	Ophioglossaceae	Botrychium	alaskense		S-facing cinder ridge, trending E-W, E of Rainbow Cr.	56.77547	158.06409
228	Ophioglossaceae	Botrychium	alaskense		Joe Klutsch's Rainbow Cr. camp	56.76743	158.08405
248	Ophioglossaceae	Botrychium	alaskense		caldera, tephra slopes on NE end of Surprise Lake	56.93364	158.10837
257	Ophioglossaceae	Botrychium	alaskense		caldera, tephra slopes on NE end of Surprise Lake	56.93730	158.08380
271	Ophioglossaceae	Botrychium	alaskense		caldera, lava headlands, W side of Surprise Lake	56.92999	158.13213
2	Ophioglossaceae	Botrychium	lanceolatum		S-facing cinder ridge, trending E-W, E of Rainbow Cr.	56.77547	158.06409
74	Ophioglossaceae	Botrychium	lanceolatum		small stream feeding into Waterfall Cr., approximately 3 km NW of Joe Klutsch's Rainbow Cr. camp	56.78250	158.10878
229	Ophioglossaceae	Botrychium	lanceolatum		Joe Klutsch's Rainbow Cr. camp	56.76743	158.08405
249	Ophioglossaceae	Botrychium	lanceolatum		caldera, tephra slopes on NE end of Surprise Lake	56.93364	158.10837
273	Ophioglossaceae	Botrychium	lanceolatum		caldera, lava headlands, W side of Surprise Lake	56.92999	158.13213
325 A	Ophioglossaceae	Botrychium	lanceolatum		ridge 100 m W of Packers' Cabin at mouth of Aniakchak R., just above outhouse	56.76366	157.49141
1 A	Ophioglossaceae	Botrychium	lunaria		S-facing cinder ridge, trending E-W, E of Rainbow Cr.	56.77547	158.06409
18	Ophioglossaceae	Botrychium	lunaria		shoulder of The Garden Wall ridge, 20m above terrace	56.78217	158.06171
71	Ophioglossaceae	Botrychium	lunaria		small stream feeding into Waterfall Cr., approximately 3 km NW of Joe Klutsch's Rainbow Cr. camp	56.78250	158.10878
179	Ophioglossaceae	Botrychium	lunaria		Meshik R. drainage, NW end of 'Island Hill Lake' on Waterfall Cr.	56.75211	158.12126
225	Ophioglossaceae	Botrychium	lunaria		Joe Klutsch's Rainbow Cr. camp	56.76743	158.08405
245	Ophioglossaceae	Botrychium	lunaria		caldera, tephra slopes on NE end of Surprise Lake	56.93364	158.10837
268	Ophioglossaceae	Botrychium	lunaria		caldera, lava headlands, W side of Surprise Lake	56.92999	158.13213
315	Ophioglossaceae	Botrychium	lunaria		W-facing slope above beach, ca. 1 km E of mouth of the Aniakchak R.	56.76321	157.47450
381	Ophioglossaceae	Botrychium	lunaria		bluff above N side of mouth of Aniakchak R., 2 km from the bay	56.76776	157.51038
19	Ophioglossaceae	Botrychium	minganense		shoulder of The Garden Wall ridge, 20m above terrace	56.78217	158.06171
73	Ophioglossaceae	Botrychium	minganense		small stream feeding into Waterfall Cr., approximately 3 km NW of Joe Klutsch's Rainbow Cr. camp	56.78250	158.10878
226	Ophioglossaceae	Botrychium	minganense		Joe Klutsch's Rainbow Cr. camp	56.76743	158.08405
246	Ophioglossaceae	Botrychium	minganense		caldera, tephra slopes on NE end of Surprise Lake	56.93364	158.10837
256	Ophioglossaceae	Botrychium	minganense		caldera, tephra slopes on NE end of Surprise Lake	56.93730	158.08380
269	Ophioglossaceae	Botrychium	minganense		caldera, lava headlands, W side of Surprise Lake	56.92999	158.13213
270	Ophioglossaceae	Botrychium	minganense		caldera, lava headlands, W side of Surprise Lake	56.92999	158.13213

314		Ophioglossaceae	Botrychium	minganense			W-facing slope above beach, ca. 1 km E of mouth of the Aniakchak R.	56.76321	157.47450
178		Ophioglossaceae	Botrychium	pedunculosum			Meshik R. drainage, NW end of 'Island Hill Lake' on Waterfall Cr.	56.75211	158.12126
1	B	Ophioglossaceae	Botrychium	pinnatum			S-facing cinder ridge, trending E-W, E of Rainbow Cr.	56.77547	158.06409
3	A	Ophioglossaceae	Botrychium	pinnatum			S-facing cinder ridge, trending E-W, E of Rainbow Cr.	56.77547	158.06409
72		Ophioglossaceae	Botrychium	pinnatum			small stream feeding into Waterfall Cr., approximately 3 km NW of Joe Klutsch's Rainbow Cr. camp	56.78250	158.10878
227		Ophioglossaceae	Botrychium	pinnatum			Joe Klutsch's Rainbow Cr. camp	56.76743	158.08405
247		Ophioglossaceae	Botrychium	pinnatum			caldera, tephra slopes on NE end of Surprise Lake	56.93364	158.10837
258		Ophioglossaceae	Botrychium	pinnatum			caldera, tephra slopes on NE end of Surprise Lake	56.93730	158.08380
272		Ophioglossaceae	Botrychium	pinnatum			caldera, lava headlands, W side of Surprise Lake	56.92999	158.13213
325	B	Ophioglossaceae	Botrychium	pinnatum			ridge 100 m W of Packers' Cabin at mouth of Aniakchak R., just above outhouse	56.76366	157.49141
180		Ophioglossaceae	Botrychium	virginianum			Meshik R. drainage, NW end of 'Island Hill Lake' on Waterfall Cr.	56.75211	158.12126
317		Poaceae	Bromus	ciliatus			W-facing slope above beach, ca. 1 km E of mouth of the Aniakchak R.	56.76321	157.47450
292		Brassicaceae	Cakile	edentula			long beach SW of mouth of Aniakchak R.	56.76107	157.51349
43		Poaceae	Calamagrostis	canadensis			Meshik R. drainage, drained pond on alluvial fan, 1.2 km S of Joe Klutsch's Rainbow Cr. camp	56.75738	158.08600
137		Poaceae	Calamagrostis	deschampsioides			Meshik R. drainage, wetlands E of Rainbow Cr., 4 km S of Joe Klutsch's Rainbow Cr. camp	56.73275	158.08263
361		Poaceae	Calamagrostis	deschampsioides			meadows on N end of Black Creek Lagoon, at mouth of creek	56.72731	157.58920
135		Poaceae	Calamagrostis	lapponica			Meshik R. drainage, wetlands E of Rainbow Cr., 4 km S of Joe Klutsch's Rainbow Cr. camp	56.73275	158.08263
153		Poaceae	Calamagrostis	stricta	ssp.	inexpansa	Meshik R., N side	56.72569	158.07430
284		Poaceae	Calamagrostis	stricta	ssp.	stricta	midstream rocky island ca. 1 km upstream of the mouth of Aniakchak R.	56.76445	157.50819
167		Callitrichaceae	Callitriche	palustris			Meshik R. drainage, small tributary of Waterfall Cr. N of 'Observation Hill'	56.77518	158.09975
186		Callitrichaceae	Callitriche	palustris			Meshik R. drainage, Waterfall Cr. area, creek draining into W side of 'Island Hill Lake'	56.74894	158.12323
65		Ranunculaceae	Caltha	palustris	ssp.	arcticus	alluvial floodplain terrace and swamp deposits S of Joe Klutsch's Rainbow Cr. camp	56.74518	158.07758
191		Brassicaceae	Cardamine	pratensis			Meshik R. drainage, Waterfall Cr. area, creek draining into W side of 'Island Hill Lake'	56.74894	158.12323
147		Brassicaceae	Cardamine	umbellata			Meshik R. drainage, wetlands E of Rainbow Cr., 4 km S of Joe Klutsch's Rainbow Cr. camp	56.73018	158.08046
86		Cyperaceae	Carex	anthoxanthea			small waterfall in subalpine stream feeding into Waterfall Cr., ca. 3 km NW of Joe Klutsch's Rainbow Cr. camp	56.79125	158.13074
39		Cyperaceae	Carex	aquatilis			Meshik R. drainage, drained pond on alluvial fan, 1.2 km S of Joe Klutsch's Rainbow Cr. camp	56.75738	158.08600
41		Cyperaceae	Carex	aquatilis	var.	aquatilis	Meshik R. drainage, drained pond on alluvial fan, 1.2 km S of Joe Klutsch's Rainbow Cr. camp	56.75738	158.08600
242		Cyperaceae	Carex	aquatilis			caldera, SW side of Surprise Lake, near outlet	56.91183	158.09214
168		Cyperaceae	Carex	bicolor			Meshik R.drainage, vic. of Waterfall Cr. adjacent to 'Observation Hill', 1.93 km W of Joe Klutsch's Rainbow Cr. camp	56.75768	158.10713
320		Cyperaceae	Carex	bicolor			W-facing slope above beach, ca. 1 km E of mouth of the Aniakchak R.	56.76321	157.47450
160		Cyperaceae	Carex	canescens			Meshik R. drainage, small tributary of Waterfall Cr. N of 'Observation Hill'	56.77518	158.09975
170		Cyperaceae	Carex	capillaris			Meshik R.drainage, vic. of Waterfall Cr. adjacent to 'Observation Hill', 1.93 km W of Joe Klutsch's Rainbow Cr. camp	56.75768	158.10713
54		Cyperaceae	Carex	chordorrhiza			alluvial floodplain terrace and swamp deposits S of Joe Klutsch's Rainbow Cr. camp	56.74518	158.07758
161		Cyperaceae	Carex	disperma			Meshik R. drainage, small tributary of Waterfall Cr. N of 'Observation Hill'	56.77518	158.09975
185		Cyperaceae	Carex	enanderi			Meshik R. drainage, NW end of 'Island Hill Lake' on Waterfall Cr.	56.75211	158.12126
310		Cyperaceae	Carex	glareosa	ssp.	glareosa	W bank of Aniakchak R., ca. 1.5 km from the mouth	56.76317	157.51254

353	Cyperaceae	Carex	glareosa	ssp. glareosa	NE corner of Black Creek Lagoon, at mouth of creek in the old Aniakchak riverbed	56.72633	157.57977
287	Cyperaceae	Carex	gmelinii		midstream rocky island ca. 1 km upstream of the mouth of Aniakchak R.	56.76445	157.50819
33	Cyperaceae	Carex	gynocrates		Meshik R. drainage, drained pond on alluvial fan, 1.2 km S of Joe Klutsch's Rainbow Cr. camp	56.75738	158.08600
34	Cyperaceae	Carex	gynocrates		Meshik R. drainage, drained pond on alluvial fan, 1.2 km S of Joe Klutsch's Rainbow Cr. camp	56.75738	158.08600
55	Cyperaceae	Carex	gynocrates		alluvial floodplain terrace and swamp deposits S of Joe Klutsch's Rainbow Cr. camp	56.74518	158.07758
215	Cyperaceae	Carex	kelloggii		Rainbow Cr., 200 m N of Joe Klutsch's camp	56.77289	158.08360
85	Cyperaceae	Carex	lachenalii		small waterfall in subalpine stream feeding into Waterfall Cr., ca. 3 km NW of Joe Klutsch's Rainbow Cr. camp	56.79125	158.13074
172	Cyperaceae	Carex	lachenalii		Meshik R.drainage, vic. of Waterfall Cr. adjacent to 'Observation Hill', 1.93 km W of Joe Klutsch's Rainbow Cr. camp	56.75768	158.10713
199	Cyperaceae	Carex	lachenalii		Meshik R. drainage, headwaters of Waterfall Cr.	56.78659	158.13443
236	Cyperaceae	Carex	lachenalii		caldera, rock outcrop on caldera wall, N of 1931 eruption site	56.91200	158.21750
159	Cyperaceae	Carex	laeviculmis		Meshik R. drainage, small tributary of Waterfall Cr. N of 'Observation Hill'	56.77518	158.09975
198	Cyperaceae	Carex	lenticularis		Meshik R. drainage, headwaters of Waterfall Cr.	56.78659	158.13443
129	Cyperaceae	Carex	limosa		Meshik R. drainage, wetlands E of Rainbow Cr., 1.5 km S of Joe Klutsch's Rainbow Cr. camp	56.74092	158.08694
343	Cyperaceae	Carex	limosa		meadow above E side of mouth of small stream emptying into Aniakchak Bay, ca. 2.25 km SE of mouth of Aniakchak R.	56.75779	157.45923
64	Cyperaceae	Carex	livida		alluvial floodplain terrace and swamp deposits S of Joe Klutsch's Rainbow Cr. camp	56.74518	158.07758
57 B	Cyperaceae	Carex	lyngbyei		alluvial floodplain terrace and swamp deposits S of Joe Klutsch's Rainbow Cr. camp	56.74518	158.07758
357	Cyperaceae	Carex	mackenziei		meadows on N end of Black Creek Lagoon, at mouth of creek	56.72731	157.58920
367	Cyperaceae	Carex	macrocephala		long beach SW of mouth of Aniakchak R.	56.71952	157.55243
46	Cyperaceae	Carex	macrochaeta		Meshik R. drainage, drained pond on alluvial fan, 1.2 km S of Joe Klutsch's Rainbow Cr. camp	56.75738	158.08600
136	Cyperaceae	Carex	media		Meshik R. drainage, wetlands E of Rainbow Cr., 4 km S of Joe Klutsch's Rainbow Cr. camp	56.73275	158.08263
171	Cyperaceae	Carex	media		Meshik R.drainage, vic. of Waterfall Cr. adjacent to 'Observation Hill', 1.93 km W of Joe Klutsch's Rainbow Cr. camp	56.75768	158.10713
339	Cyperaceae	Carex	media		meadow above E side of mouth of small stream emptying into Aniakchak Bay, ca. 2.25 km SE of mouth of Aniakchak R.	56.75779	157.45923
207	Cyperaceae	Carex	micropoda		Meshik R. drainage, upper headwaters of Waterfall Cr.	56.78482	158.14034
200	Cyperaceae	Carex	nigricans		Meshik R. drainage, headwaters of Waterfall Cr.	56.78659	158.13443
181	Cyperaceae	Carex	pachystachya		Meshik R. drainage, NW end of 'Island Hill Lake' on Waterfall Cr.	56.75211	158.12126
66	Cyperaceae	Carex	pluriflora		Meshik R. drainage, drained pond on alluvial fan, 1.2 km S of Joe Klutsch's Rainbow Cr. camp	56.75738	158.08600
359	Cyperaceae	Carex	pluriflora		meadows on N end of Black Creek Lagoon, at mouth of creek	56.72731	157.58920
358	Cyperaceae	Carex	ramenskii		meadows on N end of Black Creek Lagoon, at mouth of creek	56.72731	157.58920
49	Cyperaceae	Carex	saxatilis		Meshik R. drainage, drained pond on alluvial fan, 1.2 km S of Joe Klutsch's Rainbow Cr. camp	56.75738	158.08600
148	Cyperaceae	Carex	saxatilis		Meshik R. drainage, wetlands E of Rainbow Cr., 4 km S of Joe Klutsch's Rainbow Cr. camp	56.73018	158.08046
40	Cyperaceae	Carex	stylosa		Meshik R. drainage, drained pond on alluvial fan, 1.2 km S of Joe Klutsch's Rainbow Cr. camp	56.75738	158.08600
57 A	Cyperaceae	Carex	tenuiflora		alluvial floodplain terrace and swamp deposits S of Joe Klutsch's Rainbow Cr. camp	56.74518	158.07758
344	Cyperaceae	Carex	tenuiflora		meadow above E side of mouth of small stream emptying into Aniakchak Bay, ca. 2.25 km SE of mouth of Aniakchak R.	56.75779	157.45923
103	Cyperaceae	Carex	vaginata		S side of caldera, rock outcrop below S summit of The Garden Wall ridge	56.79570	158.04933
118	Cyperaceae	Carex	vaginata		Meshik R. drainage, S side of Aniakchak caldera, middle of The Garden Wall ridge	56.81650	158.04874
169	Cyperaceae	Carex	williamsii		Meshik R.drainage, vic. of Waterfall Cr. adjacent to 'Observation Hill', 1.93 km W of Joe Klutsch's Rainbow Cr. camp	56.75768	158.10713

105	Ericaceae	Cassiope	lycopodioides			S side of caldera, rock outcrop below S summit of The Garden Wall ridge	56.79570	158.04933
152	Scrophulariaceae	Castilleja	unalaschcensis			Meshik R., N side	56.72569	158.07430
300	Caryophyllaceae	Cerastium				sand bar islands ca. 2 km from the mouth of the Aniakchak R.	56.76681	157.52675
311	Asteraceae	Chrysanthemum	arcticum			W bank of Aniakchak R., ca. 1.5 km from the mouth	56.76317	157.51254
68	Saxifragaceae	Chrysosplenium	tetrandrum			small stream feeding into Waterfall Cr., approximately 3 km NW of Joe Klutsch's Rainbow Cr. camp	56.78250	158.10878
373	Saxifragaceae	Chrysosplenium	tetrandrum			Packers' Cabin, N side of bay	56.76438	157.48898
146	Apiaceae	Cicuta	virosa			Meshik R. drainage, wetlands E of Rainbow Cr., 4 km S of Joe Klutsch's Rainbow Cr. camp	56.73018	158.08046
183	Apiaceae	Cicuta	virosa			Meshik R. drainage, NW end of 'Island Hill Lake' on Waterfall Cr.	56.75211	158.12126
165	Portulacaceae	Claytonia	chamissoi			Meshik R. drainage, small tributary of Waterfall Cr. N of 'Observation Hill'	56.77518	158.09975
210	Portulacaceae	Claytonia	chamissoi			Rainbow Cr., 200 m N of Joe Klutsch's camp	56.77289	158.08360
79	Portulacaceae	Claytonia	sarmentosa			small waterfall in subalpine stream feeding into Waterfall Cr., ca. 3 km NW of Joe Klutsch's Rainbow Cr. camp	56.79125	158.13074
190	Portulacaceae	Claytonia	sibirica			Meshik R. drainage, Waterfall Cr. area, creek draining into W side of 'Island Hill Lake'	56.74894	158.12323
331	Brassicaceae	Cochlearia	officinalis	ssp.	oblongifolia	mouth of Aniakchak R., E side	56.76285	157.49223
154	Orchidaceae	Coeloglossum	viride			Meshik R., N side	56.72569	158.07430
52	Orchidaceae	Corallorhiza	trifida			alluvial floodplain terrace and swamp deposits S of Joe Klutsch's Rainbow Cr. camp	56.74518	158.07758
99	Adiantaceea	Cryptogramma	acrostichoides			S side of caldera, rock outcrop below S summit of The Garden Wall ridge	56.79570	158.04933
313	Orchidaceae	Cypripedium	guttatum			W-facing slope above beach, ca. 1 km E of mouth of the Aniakchak R.	56.76321	157.47450
16	Poaceae	Deschampsia	cespitosa	ssp.	orientalis	raised terrace E of W fork of upper Cub Cr.	56.77671	158.06400
89	Poaceae	Deschampsia	cespitosa	ssp.	orientalis	S side of caldera, rock outcrop below S summit of The Garden Wall ridge	56.79570	158.04933
193	Poaceae	Douglasia	alaskana			Meshik R. drainage, rock outcrop on N side of 'Island Hill' above lake	56.74721	158.12148
112	Brassicaceae	Draba	borealis			Meshik R. drainage, S side of caldera, The Garden Wall ridge	56.80682	158.04929
195	Brassicaceae	Draba	borealis			Meshik R. drainage, rock outcrop on N side of 'Island Hill' above lake	56.74721	158.12148
285	Brassicaceae	Draba	borealis			midstream rocky island ca. 1 km upstream of the mouth of Aniakchak R.	56.76445	157.50819
321	Brassicaceae	Draba	borealis			W-facing slope above beach, ca. 1 km E of mouth of the Aniakchak R.	56.76321	157.47450
261	Brassicaceae	Draba	juvenlilis			caldera, limestone scree slopes on S side of 'The Gates'	56.90313	158.07821
94	Brassicaceae	Draba	lonchocarpa	var.	lonchocarpa	S side of caldera, rock outcrop below S summit of The Garden Wall ridge	56.79570	158.04933
95	Brassicaceae	Draba	lonchocarpa	var.	lonchocarpa	S side of caldera, rock outcrop below S summit of The Garden Wall ridge	56.79570	158.04933
116	Brassicaceae	Draba	lonchocarpa			Meshik R. drainage, S side of Aniakchak caldera, middle of The Garden Wall ridge	56.81650	158.04874
124	Brassicaceae	Draba	lonchocarpa	var.	lonchocarpa	Meshik R. drainage, S side of Aniakchak caldera, middle of The Garden Wall ridge	56.81978	158.04936
125	Brassicaceae	Draba	lonchocarpa	var.	lonchocarpa	Meshik R. drainage, S side of Aniakchak caldera, middle of The Garden Wall ridge	56.81978	158.04936
126	Brassicaceae	Draba	lonchocarpa	var.	lonchocarpa	Meshik R. drainage, S side of Aniakchak caldera, middle of The Garden Wall ridge	56.81978	158.04936
127	Brassicaceae	Draba	lonchocarpa	var.	lonchocarpa	Meshik R. drainage, S side of Aniakchak caldera, middle of The Garden Wall ridge	56.81978	158.04936
196	Brassicaceae	Draba	lonchocarpa			Meshik R. drainage, rock outcrop on N side of 'Island Hill' above lake	56.74721	158.12148
233	Brassicaceae	Draba	lonchocarpa			caldera, rock outcrop on caldera wall, N of 1931 eruption site	56.91200	158.21750

255	Brassicaceae	Draba	lonchocarpa	var.	lonchocarpa	caldera, tephra slopes on NE end of Surprise Lake	56.93730	158.08380
278	Brassicaceae	Draba	lonchocarpa			caldera, lava headlands, W side of Surprise Lake	56.92999	158.13213
260	Brassicaceae	Draba	macounii			caldera, limestone scree slopes on S side of 'The Gates'	56.90313	158.07821
115	Brassicaceae	Draba	nivalis			Meshik R. drainage, S side of Aniakchak caldera, middle of The Garden Wall ridge	56.81650	158.04874
383	Brassicaceae	Draba	nivalis			Packers' Cabin, N side of bay	56.76438	157.48898
130	Droceraceae	Drosera	rotundifolia			Meshik R. drainage, wetlands E of Rainbow Cr., 1.5 km S of Joe Klutsch's Rainbow Cr. camp	56.74092	158.08694
11	Rosaceae	Dryas	integrifolia			raised terrace E of W fork of upper Cub Cr.	56.77671	158.06400
37	Poaceae	Dupontia	fisheri	ssp.	psilosantha	Meshik R. drainage, drained pond on alluvial fan, 1.2 km S of Joe Klutsch's Rainbow Cr. camp	56.75738	158.08600
56	Poaceae	Dupontia	fisheri	ssp.	psilosantha	alluvial floodplain terrace and swamp deposits S of Joe Klutsch's Rainbow Cr. camp	56.74518	158.07758
365	Poaceae	Dupontia	fisheri	ssp.	psilosantha	meadows on N end of Black Creek Lagoon, at mouth of creek	56.72731	157.58920
302	Cyperaceae	Eleocharis	kamtschatica			late succession pond and meadows SW of Aniakchak R., ca. 2.5 km from the mouth	56.76677	157.53722
345	Cyperaceae	Eleocharis	kamtschatica			meadow above E side of mouth of small stream emptying into Aniakchak Bay, ca. 2.25 km SE of mouth of Aniakchak R.	56.75779	157.45923
360	Cyperaceae	Eleocharis	kamtschatica			meadows on N end of Black Creek Lagoon, at mouth of creek	56.72731	157.58920
128	Poaceae	Elymus	trachycaulus	ssp.	majus	Meshik R. drainage, S side of Aniakchak caldera, SE end of The Garden Wall ridge, toe of slope	56.78191	158.05423
329	Poaceae	Elymus	trachycaulus	ssp.	majus	ridge 100 m W of Packers' Cabin at mouth of Aniakchak R., just above outhouse	56.76366	157.49141
182	Poaceae	Elymus	trachycaulus	ssp.	majus	Meshik R. drainage, NW end of 'Island Hill Lake' on Waterfall Cr.	56.75211	158.12126
175	Onagraceae	Epilobium	palustre			Meshik R.drainage, vic. of Waterfall Cr. adjacent to 'Observation Hill', 1.93 km W of Joe Klutsch's Rainbow Cr. camp	56.75768	158.10713
44	Equisetaceae	Equisetum	arvense			Meshik R. drainage, drained pond on alluvial fan, 1.2 km S of Joe Klutsch's Rainbow Cr. camp	56.75738	158.08600
253 B	Equisetaceae	Equisetum	arvense			caldera, tephra slopes on NE end of Surprise Lake	56.93364	158.10837
254	Equisetaceae	Equisetum	arvense			caldera, tephra slopes on NE end of Surprise Lake	56.93603	158.11375
192	Equisetaceae	Equisetum	pratense			Meshik R. drainage, meadow on N side of 'Island Hill' above lake	56.74721	158.12148
201	Equisetaceae	Equisetum	scirpoides			Meshik R. drainage, headwaters of Waterfall Cr.	56.78659	158.13443
134	Cyperaceae	Eriophorum	gracile			Meshik R. drainage, wetlands E of Rainbow Cr., 4 km S of Joe Klutsch's Rainbow Cr. camp	56.73275	158.08263
342	Cyperaceae	Eriophorum	gracile			meadow above E side of mouth of small stream emptying into Aniakchak Bay, ca. 2.25 km SE of mouth of Aniakchak R.	56.75779	157.45923
60	Cyperaceae	Eriophorum	russeolum			alluvial floodplain terrace and swamp deposits S of Joe Klutsch's Rainbow Cr. camp	56.74518	158.07758
142	Cyperaceae	Eriophorum	russeolum			Meshik R. drainage, wetlands E of Rainbow Cr., 4 km S of Joe Klutsch's Rainbow Cr. camp	56.73275	158.08263
326	Scrophulariaceae	Euphrasia	mollis			ridge 100 m W of Packers' Cabin at mouth of Aniakchak R., just above outhouse	56.76366	157.49141
122	Poaceae	Festuca	rubra	ssp.	richardsonii	Meshik R. drainage, S side of Aniakchak caldera, middle of The Garden Wall ridge	56.81978	158.04936
151	Poaceae	Festuca	rubra	ssp.	richardsonii	Meshik R., N side	56.72569	158.07430
164	Liliaceae	Fritillaria	camschatcensis			Meshik R. drainage, small tributary of Waterfall Cr. N of 'Observation Hill'	56.77518	158.09975
330	Rubiaceae	Galium	aparine			mouth of Aniakchak R., E side	56.76466	157.49303
166	Rubiaceae	Galium	trifidum	ssp.	trifidum	Meshik R. drainage, small tributary of Waterfall Cr. N of 'Observation Hill'	56.77518	158.09975
25	Rubiaceae	Galium	triflorum			shoulder of The Garden Wall ridge, 20m above terrace	56.78217	158.06171
176	Rubiaceae	Galium	triflorum			Meshik R. drainage, NW end of 'Island Hill Lake' on Waterfall Cr.	56.75211	158.12126
90	Gentianaceae	Gentiana	algida			S side of caldera, rock outcrop below S summit of The Garden Wall ridge	56.79570	158.04933
252	Gentianaceae	Gentiana	amarella			caldera, tephra slopes on NE end of Surprise Lake	56.93364	158.10837

277	Gentianaceae	Gentianella	propinqua	ssp.	aleutica	caldera, lava headlands, W side of Surprise Lake	56.92999	158.13213
370	Gentianaceae	Gentianella	propinqua	ssp.	propinqua	ridge 100 m W of Packers' Cabin at mouth of Aniakchak R., just above outhouse	56.76366	157.49141
332	Gentianaceae	Gentiana	prostrata			S-facing cliff on Aniakchak Bay, approxiamately 1.25 km E of Aniakchak R.	56.76212	157.47449
276	Gentianaceae	Gentianella	tenella			caldera, lava headlands, W side of Surprise Lake	56.92999	158.13213
69	Aspleniaceae	Gymnocarpium	dryopteris			small stream feeding into Waterfall Cr., approximately 3 km NW of Joe Klutsch's Rainbow Cr. camp	56.78250	158.10878
138	Poaceae	Hierochloe	odorata			Meshik R. drainage, wetlands E of Rainbow Cr., 4 km S of Joe Klutsch's Rainbow Cr. camp	56.73275	158.08263
366	Poaceae	Hierochloe	pauciflora			meadows on N end of Black Creek Lagoon, at mouth of creek	56.72731	157.58920
208	Halagoraceae	Hippuris	montana			Meshik R. drainage, upper headwaters of Waterfall Cr.	56.78482	158.14034
354	Halagoraceae	Hippuris	tetraphylla			NE corner of Black Creek Lagoon, at mouth of creek in the old Aniakchak riverbed	56.72633	157.57977
289	Caryophyllaceae	Honckenya	peploides			long beach SW of mouth of Aniakchak R.	56.76107	157.51349
150	Poaceae	Hordeum	brachyantherum			Meshik R., N side	56.72569	158.07430
303	Iridaceae	Iris	setosa			late succession pond and meadows SW of Aniakchak R., ca. 2.5 km from the mouth	56.76677	157.53722
304	Isoetaceae	Isoetes	echinospora			late succession pond and meadows SW of Aniakchak R., ca. 2.5 km from the mouth	56.76677	157.53722
32	Juncaceae	Juncus	biglumis			Meshik R. drainage, drained pond on alluvial fan, 1.2 km S of Joe Klutsch's Rainbow Cr. camp	56.75738	158.08600
308	Juncaceae	Juncus	bufonius			W bank of Aniakchak R., ca. 1.5 km from the mouth	56.76317	157.51254
35	Juncaceae	Juncus	castaneus			Meshik R. drainage, drained pond on alluvial fan, 1.2 km S of Joe Klutsch's Rainbow Cr. camp	56.75738	158.08600
140	Juncaceae	Juncus	triglumis	ssp.	albescens	Meshik R. drainage, wetlands E of Rainbow Cr., 4 km S of Joe Klutsch's Rainbow Cr. camp	56.73275	158.08263
82	Scrophulariaceae	Lagotis	glauca			small waterfall in subalpine stream feeding into Waterfall Cr., ca. 3 km NW of Joe Klutsch's Rainbow Cr. camp	56.79125	158.13074
294	Fabaceae	Lathyrus	maritimus			long beach SW of mouth of Aniakchak R.	56.76107	157.51349
307	Fabaceae	Lathyrus	palustris			W bank of Aniakchak R., ca. 1.5 km from the mouth	56.76471	157.52264
45	Ericaceae	Ledum	palustre	ssp.	decumbens	Meshik R. drainage, drained pond on alluvial fan, 1.2 km S of Joe Klutsch's Rainbow Cr. camp	56.75738	158.08600
241	Scrophulariaceae	Limosella	aquatica			caldera, inlet of Surprise Lake, where creek empties into lake	56.93219	158.12039
296	Scrophulariaceae	Limosella	aquatica			sand bar islands ca. 2 km from the mouth of the Aniakchak R.	56.76681	157.52675
81	Liliaceae	Lloydia	serotina			small waterfall in subalpine stream feeding into Waterfall Cr., ca. 3 km NW of Joe Klutsch's Rainbow Cr. camp	56.79125	158.13074
173	Gentianaceae	Lomatogonium	rotatum			Meshik R.drainage, vic. of Waterfall Cr. adjacent to 'Observation Hill', 1.93 km W of Joe Klutsch's Rainbow Cr. camp	56.75768	158.10713
97	Juncaceae	Luzula	arcuata	ssp.	arcuata	S side of caldera, rock outcrop below S summit of The Garden Wall ridge	56.79570	158.04933
274	Juncaceae	Luzula	kjellmaniana			caldera, lava headlands, W side of Surprise Lake	56.92999	158.13213
333	Juncaceae	Luzula	kjellmaniana			S-facing cliff on Aniakchak Bay, approxiamately 1.25 km E of Aniakchak R.	56.76212	157.47449
368	Juncaceae	Luzula	kjellmaniana			ridge 100 m W of Packers' Cabin at mouth of Aniakchak R., just above outhouse	56.76366	157.49141
316	Juncaceae	Luzula	multiflora	ssp.	multiflora	W-facing slope above beach, ca. 1 km E of mouth of the Aniakchak R.	56.76321	157.47450
364	Juncaceae	Luzula	multiflora	ssp.	multiflora	meadows on N end of Black Creek Lagoon, at mouth of creek	56.72731	157.58920
98	Juncaceae	Luzula	spicata			S side of caldera, rock outcrop below S summit of The Garden Wall ridge	56.79570	158.04933
63	Gentianaceae	Menyanthes	trifoliata			alluvial floodplain terrace and swamp deposits S of Joe Klutsch's Rainbow Cr. camp	56.74518	158.07758
290	Boraginaceae	Mertensia	maritima			long beach SW of mouth of Aniakchak R.	56.76107	157.51349
174	Caryophyllaceae	Minuartia	arctica			Meshik R.drainage, vic. of Waterfall Cr. adjacent to 'Observation Hill', 1.93 km W of Joe Klutsch's Rainbow Cr. camp	56.75768	158.10713
109	Caryophyllaceae	Minuartia	biflora			Meshik R. drainage, S side of caldera, The Garden Wall ridge	56.80682	158.04929

108	Caryophyllaceae	Minuartia	rubella		Meshik R. drainage, S side of caldera, The Garden Wall ridge	56.80682	158.04929
262	Caryophyllaceae	Minuartia	rubella		caldera, limestone scree slopes on S side of 'The Gates'	56.90313	158.07821
7	Caryophyllaceae	Moehringia	lateriflora		S-facing cinder ridge, trending E-W, E of Rainbow Cr.	56.77553	158.06387
211	Portulacaceae	Montia	fontana		Rainbow Cr., 200 m N of Joe Klutsch's camp	56.77289	158.08360
323	Orobanchaceae	Orobanche	uniflora		ridge 100 m W of Packers' Cabin at mouth of Aniakchak R., just above outhouse	56.76413	157.49112
324	Orobanchaceae	Orobanche	uniflora		ridge 100 m W of Packers' Cabin at mouth of Aniakchak R., just above outhouse	56.76366	157.49141
379	Orobanchaceae	Orobanche	uniflora		bluff above N side of mouth of Aniakchak R., 2 km from the bay	56.76776	157.51038
51	Ericaceae	Oxycoccus	microcarpus		alluvial floodplain terrace and swamp deposits S of Joe Klutsch's Rainbow Cr. camp	56.74518	158.07758
13	Fabaceae	Oxytropis	bryophila		raised terrace E of W fork of upper Cub Cr.	56.77671	158.06400
222	Fabaceae	Oxytropis	bryophila		exposed ash flats E of Joe Klutsch's Rainbow Cr. camp	56.76714	158.06151
224 B	Polygonaceae	Oxytropis	maydelliana		airstrip at Joe Klutsch's camp, near Rainbow Cr.	56.76714	158.08166
15	Asteraceae	Packera	cymbalaria		raised terrace E of W fork of upper Cub Cr.	56.77671	158.06400
194	Asteraceae	Packera	cymbalaria		Meshik R. drainage, rock outcrop on N side of 'Island Hill' above lake	56.74721	158.12148
319	Asteraceae	Packera	cymbalaria		W-facing slope above beach, ca. 1 km E of mouth of the Aniakchak R.	56.76321	157.47450
123	Papaveraceae	Papaver			Meshik R. drainage, S side of Aniakchak caldera, middle of The Garden Wall ridge	56.81978	158.04936
221	Papaveraceae	Papaver			exposed ash flats E of Joe Klutsch's Rainbow Cr. camp	56.76714	158.06151
337	Scrophulariaceae	Pedicularis	labradorica		meadow above E side of mouth of small stream emptying into Aniakchak Bay, ca. 2.25 km SE of mouth of Aniakchak R.	56.75779	157.45923
14	Scrophulariaceae	Pedicularis	lanata		raised terrace E of W fork of upper Cub Cr.	56.77671	158.06400
61	Scrophulariaceae	Pedicularis	pacifica		alluvial floodplain terrace and swamp deposits S of Joe Klutsch's Rainbow Cr. camp	56.74518	158.07758
62	Scrophulariaceae	Pedicularis	parviflora	spp. pennellii	alluvial floodplain terrace and swamp deposits S of Joe Klutsch's Rainbow Cr. camp	56.74518	158.07758
209	Asteraceae	Petasites	frigidus		Meshik R. drainage, upper headwaters of Waterfall Cr.	56.78482	158.14034
322	Potamogetonaceae	Phyllospadix	serrulatus		tidepools below W facing slope above beach, ca. 1 km E of mouth of the Aniakchak R.	56.76332	157.47533
220	Utriculariaceae	Pinguicula	vulgaris		Meshik R. drainage- drained pond on alluvial fan, 1.2 km S of Joe Klutsch's Rainbow Cr. camp	56.75738	158.08600
295	Boraginaceae	Plagiobothrys	orientalis		sand bar islands ca. 2 km from the mouth of the Aniakchak R.	56.76681	157.52675
282	Plantaginaceae	Plantago	maritima		midstream rocky island ca. 1 km upstream of the mouth of Aniakchak R.	56.76445	157.50819
42	Orchidaceae	Platanthera	aquilonis		Meshik R. drainage, drained pond on alluvial fan, 1.2 km S of Joe Klutsch's Rainbow Cr. camp	56.75738	158.08600
275	Orchidaceae	Platanthera	obtusata		caldera, lava headlands, W side of Surprise Lake	56.92999	158.13213
250	Orchidaceae	Platanthera	stricta		caldera, tephra slopes on NE end of Surprise Lake	56.93364	158.10837
101	Poaceae	Poa	alpina		S side of caldera, rock outcrop below S summit of The Garden Wall ridge	56.79570	158.04933
47	Poaceae	Poa	arctica		Meshik R. drainage, drained pond on alluvial fan, 1.2 km S of Joe Klutsch's Rainbow Cr. camp	56.75738	158.08600
59	Poaceae	Poa	arctica		alluvial floodplain terrace and swamp deposits S of Joe Klutsch's Rainbow Cr. camp	56.74518	158.07758
253 A	Poaceae	Poa	arctica		caldera, tephra slopes on NE end of Surprise Lake	56.93364	158.10837
369	Poaceae	Poa	arctica		ridge 100 m W of Packers' Cabin at mouth of Aniakchak R., just above outhouse	56.76366	157.49141
212	Poaceae	Poa	eminens		Rainbow Cr., 200 m N of Joe Klutsch's camp	56.77289	158.08360
213	Poaceae	Poa	eminens		Rainbow Cr., 200 m N of Joe Klutsch's camp	56.77289	158.08360
197	Poaceae	Poa	glauca		Meshik R. drainage, rock outcrop on N side of 'Island Hill' above lake	56.74721	158.12148

21	Poaceae	Poa	palustris	shoulder of The Garden Wall ridge, 20m above terrace	56.78217	158.06171
22	Poaceae	Poa	palustris	shoulder of The Garden Wall ridge, 20m above terrace	56.78217	158.06171
177	Poaceae	Poa	palustris	Meshik R. drainage, NW end of 'Island Hill Lake' on Waterfall Cr.	56.75211	158.12126
375	Poaceae	Poa	palustris	Packers' Cabin, N side of bay	56.76438	157.48898
235	Poaceae	Poa	paucispicula	caldera, rock outcrop on caldera wall, N of 1931 eruption site	56.91200	158.21750
264	Poaceae	Poa	paucispicula	caldera, limestone scree slopes on S side of 'The Gates'	56.90313	158.07821
218	Poaceae	Poa	pratensis	Rainbow Cr., 200 m N of Joe Klutsch's camp	56.77289	158.08360
288	Poaceae	Poa	pratensis	midstream rocky island ca. 1 km upstream of the mouth of Aniakchak R.	56.76445	157.50819
117	Poaceae	Poa	pseudoabbreviata	Meshik R. drainage, S side of Aniakchak caldera, middle of The Garden Wall ridge	56.81650	158.04874
120	Poaceae	Poa	pseudoabbreviata	Meshik R. drainage, S side of Aniakchak caldera, middle of The Garden Wall ridge	56.81978	158.04936
70	Poaceae	Poa	stenantha	small stream feeding into Waterfall Cr., approximately 3 km NW of Joe Klutsch's Rainbow Cr. camp	56.78250	158.10878
346	Poaceae	Poa	stenantha	S-facing cliff on Aniakchak Bay, approxiamately 1.25 km E of Aniakchak R.	56.76212	157.47449
328	Apiaceae	Podistera	macounii	ridge 100 m W of Packers' Cabin at mouth of Aniakchak R., just above outhouse	56.76366	157.49141
230	Polemoniaceae	Polemonium	boreale	caldera, tephra slope, NE of 1931 vent	56.91469	158.19699
238	Polemoniaceae	Polemonium	boreale	caldera, W side of Surprise Lake, S of Bolshoi Dome	56.92701	158.11918
240	Polemoniaceae	Polemonium	boreale	caldera, lava dome at NW end of Surprise Lake, NW of Bolshoi Dome	56.93063	158.13525
244	Polemoniaceae	Polemonium	boreale	caldera, SW side of Surprise Lake	56.91646	158.10812
265	Polemoniaceae	Polemonium	boreale	caldera, tephra slopes of ridge NE of Vent Mtn.	56.90370	158.13367
267	Polemoniaceae	Polemonium	boreale	caldera, E slope of Vent Mtn., halfway up	56.88953	158.13704
119	Polemoniaceae	Polemonium	pulcherrimum	Meshik R. drainage, S side of Aniakchak caldera, middle of The Garden Wall ridge	56.81978	158.04936
286	Polypodiaceae	Polypodium	glycyrrhiza	midstream rocky island ca. 1 km upstream of the mouth of Aniakchak R.	56.76445	157.50819
144	Potamogetonaceae	Potamogeton	alpinus	Meshik R. drainage, wetlands E of Rainbow Cr., 4 km S of Joe Klutsch's Rainbow Cr. camp	56.73018	158.08046
348	Potamogetonaceae	Potamogeton	filiformis	NE corner of Black Creek Lagoon, at mouth of creek in the old Aniakchak riverbed	56.72633	157.57977
362	Potamogetonaceae	Potamogeton	filiformis	meadows on N end of Black Creek Lagoon, at mouth of creek	56.72731	157.58920
184	Potamogetonaceae	Potamogeton	pusillus	Meshik R. drainage, NW end of 'Island Hill Lake' on Waterfall Cr.	56.75211	158.12126
363	Potamogetonaceae	Potamogeton	pusillus	meadows on N end of Black Creek Lagoon, at mouth of creek	56.72731	157.58920
141	Potamogetonaceae	Potamogeton	richardsonii	Meshik R. drainage, wetlands E of Rainbow Cr., 4 km S of Joe Klutsch's Rainbow Cr. camp	56.73275	158.08263
110	Rosaceae	Potentilla	hyparctica	Meshik R. drainage, S side of caldera, The Garden Wall ridge	56.80682	158.04929
263	Rosaceae	Potentilla	hyparctica	caldera, limestone scree slopes on S side of 'The Gates'	56.90313	158.07821
77	Asteraceae	Prenanthes	alata	small stream feeding into Waterfall Cr., approximately 3 km NW of Joe Klutsch's Rainbow Cr. camp	56.78250	158.10878
318	Asteraceae	Prenanthes	alata	W-facing slope above beach, ca. 1 km E of mouth of the Aniakchak R.	56.76321	157.47450
80	Primulaceae	Primula	cuneifolia	small waterfall in subalpine stream feeding into Waterfall Cr., ca. 3 km NW of Joe Klutsch's Rainbow Cr. camp	56.79125	158.13074
104	Primulaceae	Primula	cuneifolia	S side of caldera, rock outcrop below S summit of The Garden Wall ridge	56.79570	158.04933
205	Primulaceae	Primula	eximia	Meshik R. drainage, headwaters of Waterfall Cr.	56.78426	158.13602
281	Poaceae	Puccinellia	langeana	midstream rocky island ca. 1 km upstream of the mouth of Aniakchak R.	56.76445	157.50819
347	Poaceae	Puccinellia	nutkaensis	NE corner of Black Creek Lagoon, at mouth of creek in the old Aniakchak riverbed	56.72633	157.57977

349	Poaceae	Puccinellia	nutkaensis		NE corner of Black Creek Lagoon, at mouth of creek in the old Aniakchak riverbed	56.72633	157.57977
350	Poaceae	Puccinellia	nutkaensis		NE corner of Black Creek Lagoon, at mouth of creek in the old Aniakchak riverbed	56.72633	157.57977
355	Poaceae	Puccinellia	phryganodes		NE corner of Black Creek Lagoon, at mouth of creek in the old Aniakchak riverbed	56.72633	157.57977
76	Ranunculaceae	Ranunculus	abortivus		small stream feeding into Waterfall Cr., approximately 3 km NW of Joe Klutsch's Rainbow Cr. camp	56.78250	158.10878
301	Ranunculaceae	Ranunculus	flammula	var. reptans	late succession pond and meadows SW of Aniakchak R., ca. 2.5 km from the mouth	56.76677	157.53722
107	Ranunculaceae	Ranunculus	gelidus		Meshik R. drainage, S side of caldera, The Garden Wall ridge	56.80682	158.04929
131	Ranunculaceae	Ranunculus	pallasii		Meshik R. drainage, wetlands E of Rainbow Cr., 4 km S of Joe Klutsch's Rainbow Cr. camp	56.73275	158.08263
93	Hydrophyllaceae	Romanzoffia	unalaschcensis		S side of caldera, rock outcrop below S summit of The Garden Wall ridge	56.79570	158.04933
156	Brassicaceae	Rorippa	palustris		Meshik R., N side	56.72569	158.07430
297	Brassicaceae	Rorippa	palustris		sand bar islands ca. 2 km from the mouth of the Aniakchak R.	56.76681	157.52675
338	Rosaceae	Rubus	chamaemorus		meadow above E side of mouth of small stream emptying into Aniakchak Bay, ca. 2.25 km SE of mouth of Aniakchak R.	56.75779	157.45923
27	Rosaceae	Rubus	spectabilis		shoulder of The Garden Wall ridge, 20m above terrace	56.78217	158.06171
38	Polygonaceae	Rumex	arcticus		Meshik R. drainage, drained pond on alluvial fan, 1.2 km S of Joe Klutsch's Rainbow Cr. camp	56.75738	158.08600
9	Polygonaceae	Rumex	beringensis		exposed open sand area just N of S-facing cinder ridge, trending E-W, E of Rainbow Cr.	56.77500	158.06410
30	Polygonaceae	Rumex	beringensis		meadow E of W fork of upper Cub Cr.	56.77671	158.06400
88	Polygonaceae	Rumex	beringensis		small waterfall in subalpine stream feeding into Waterfall Cr., ca. 3 km NW of Joe Klutsch's Rainbow Cr. camp	56.79125	158.13074
224 A	Polygonaceae	Rumex	beringensis		exposed ash flats E of Joe Klutsch's Rainbow Cr. camp	56.76817	158.06151
279	Polygonaceae	Rumex	beringensis		caldera, E slope of Vent Mtn., halfway up	56.88950	158.13152
356	Potamogetonaceae	Ruppia	cirrhosa		meadows on N end of Black Creek Lagoon, at mouth of creek	56.72731	157.58920
187	Caryophyllaceae	Sagina	maxima	ssp. crassicaulis	Meshik R. drainage, Waterfall Cr. area, creek draining into W side of 'Island Hill Lake'	56.74894	158.12323
217	Salicaceae	Salix	commutata		Rainbow Cr., 200 m N of Joe Klutsch's camp	56.77289	158.08360
53	Salicaceae	Salix	fuscescens		alluvial floodplain terrace and swamp deposits S of Joe Klutsch's Rainbow Cr. camp	56.74518	158.07758
5	Salicaceae	Salix	glauca		S-facing cinder ridge, trending E-W, E of Rainbow Cr.	56.77553	158.06387
50	Salicaceae	Salix	ovalifolia		alluvial floodplain terrace S of Joe Klutsch's Rainbow Cr. camp	56.74518	158.07758
111	Salicaceae	Salix	ovalifolia		Meshik R. drainage, S side of caldera, The Garden Wall ridge	56.80682	158.04929
239	Salicaceae	Salix	ovalifolia		caldera, W side of Surprise Lake, S of Bolshoi Dome	56.92701	158.11918
243	Salicaceae	Salix	ovalifolia		caldera, W side of large maar at base of Black Nose	56.89041	158.08869
4	Salicaceae	Salix	pulchra		S-facing cinder ridge, trending E-W, E of Rainbow Cr.	56.77553	158.06387
106	Salicaceae	Salix	rotundifolia		S side of caldera, rock outcrop below S summit of The Garden Wall ridge	56.79570	158.04933
24	Caprifoliaceae	Sambucus	racemosa		shoulder of The Garden Wall ridge, 20m above terrace	56.78217	158.06171
336	Asteraceae	Saussurea	angustifolia		meadow above E side of mouth of small stream emptying into Aniakchak Bay, ca. 2.25 km SE of mouth of Aniakchak R.	56.75779	157.45923
114	Saxifragaceae	Saxifraga	bracteata		Meshik R. drainage, S side of Aniakchak caldera, middle of The Garden Wall ridge	56.81650	158.04874
232	Saxifragaceae	Saxifraga	bracteata		caldera, rock outcrop on caldera wall, N of 1931 eruption site	56.91200	158.21750
92	Saxifragaceae	Saxifraga	caespitosa		S side of caldera, rock outcrop below S summit of The Garden Wall ridge	56.79570	158.04933
231	Saxifragaceae	Saxifraga	caespitosa		caldera, rock outcrop on caldera wall, N of 1931 eruption site	56.91200	158.21750
102	Saxifragaceae	Saxifraga	flagellaris		S side of caldera, rock outcrop below S summit of The Garden Wall ridge	56.79570	158.04933

36	Saxifragaceae	Saxifraga	foliolosa			Meshik R. drainage, drained pond on alluvial fan, 1.2 km S of Joe Klutsch's Rainbow Cr. camp	56.75738	158.08600
237 B	Saxifragaceae	Saxifraga	foliolosa			caldera, rock outcrop on caldera wall, N of 1931 eruption site	56.91200	158.21750
17	Caryophyllaceae	Silene	acaulis			terrace at base of The Garden Wall ridge	56.78043	158.06282
143	Sparganiaceae	Sparganium	angustifolium			Meshik R. drainage, wetlands E of Rainbow Cr., 4 km S of Joe Klutsch's Rainbow Cr. camp	56.73018	158.08046
132	Sparganiaceae	Sparganium	hyperboreum			Meshik R. drainage, wetlands E of Rainbow Cr., 4 km S of Joe Klutsch's Rainbow Cr. camp	56.73275	158.08263
234	Caryophyllaceae	Stellaria	calycantha			caldera, rock outcrop on caldera wall, N of 1931 eruption site	56.91200	158.21750
139	Caryophyllaceae	Stellaria	crassifolia			Meshik R. drainage, wetlands E of Rainbow Cr., 4 km S of Joe Klutsch's Rainbow Cr. camp	56.73275	158.08263
298	Caryophyllaceae	Stellaria	crassifolia			sand bar islands ca. 2 km from the mouth of the Aniakchak R.	56.76681	157.52675
309	Caryophyllaceae	Stellaria	humifusa			W bank of Aniakchak R., ca. 1.5 km from the mouth	56.76317	157.51254
351	Caryophyllaceae	Stellaria	humifusa			NE corner of Black Creek Lagoon, at mouth of creek in the old Aniakchak riverbed	56.72633	157.57977
299	Caryophyllaceae	Stellaria	longipes			sand bar islands ca. 2 km from the mouth of the Aniakchak R.	56.76681	157.52675
280	Caryophyllaceae	Stellaria	monantha			caldera, marshy inlet of Surprise Lake	56.93219	158.12039
26	Liliaceae	Streptopus	amplexifolius			shoulder of The Garden Wall ridge, 20m above terrace	56.78217	158.06171
203	Liliaceae	Streptopus	amplexifolius			Meshik R. drainage, headwaters of Waterfall Cr.	56.78659	158.13443
305	Brassicaceae	Subularia	aquatica			late succession pond and meadows SW of Aniakchak R., ca. 2.5 km from the mouth	56.76677	157.53722
121	Asteraceae	Taraxacum	ceratophorum			Meshik R. drainage, S side of Aniakchak caldera, middle of The Garden Wall ridge	56.81978	158.04936
266	Asteraceae	Taraxacum	ceratophorum			caldera, NE slope of Vent Mtn.	56.89555	158.13199
91	Asteraceae	Taraxacum	kamtschaticum			S side of caldera, rock outcrop below S summit of The Garden Wall ridge	56.79570	158.04933
251	Asteraceae	Taraxacum	kamtschaticum			caldera, tephra slopes on NE end of Surprise Lake	56.93364	158.10837
189	Asteraceae	Taraxacum	trigonolobum			Meshik R. drainage, Waterfall Cr. area, creek draining into W side of 'Island Hill Lake'	56.74894	158.12323
372	Asteraceae	Taraxacum	trigonolobum			ridge 100 m W of Packers' Cabin at mouth of Aniakchak R., just above outhouse	56.76366	157.49141
29	Saxifragaceae	Tellima	grandiflora			shoulder of The Garden Wall ridge, 20m above terrace	56.78217	158.06171
31	Cyperaceae	Trichophorum	cespitosum			Meshik R. drainage, drained pond on alluvial fan, 1.2 km S of Joe Klutsch's Rainbow Cr. camp	56.75738	158.08600
306	Juncaginaceae	Triglochin	maritima			W bank of Aniakchak R., ca. 1.5 km from the mouth	56.76471	157.52264
58	Juncaginaceae	Triglochin	palustris			alluvial floodplain terrace and swamp deposits S of Joe Klutsch's Rainbow Cr. camp	56.74518	158.07758
23	Poaceae	Trisetum	spicatum			shoulder of The Garden Wall ridge, 20m above terrace	56.78217	158.06171
377	Urticaceae	Urtica	dioica	ssp.	gracilis	mouth of Aniakchak R., NE side, ca. 1 km from the bay	56.76611	157.50545
133	Utriculariaceae	Utricularia	minor			Meshik R. drainage, wetlands E of Rainbow Cr., 4 km S of Joe Klutsch's Rainbow Cr. camp	56.73275	158.08263
340	Utriculariaceae	Utricularia	minor			meadow above E side of mouth of small stream emptying into Aniakchak Bay, ca. 2.25 km SE of mouth of Aniakchak R.	56.75779	157.45923
341	Utriculariaceae	Utricularia	minor			meadow above E side of mouth of small stream emptying into Aniakchak Bay, ca. 2.25 km SE of mouth of Aniakchak R.	56.75779	157.45923
163	Scrophulariaceae	Veronica	americana			Meshik R. drainage, small tributary of Waterfall Cr. N of 'Observation Hill'	56.77518	158.09975
157	Scrophulariaceae	Veronica	serpyllifolia			Meshik R., N side	56.72569	158.07430
204	Scrophulariaceae	Veronica	stelleri			Meshik R. drainage, headwaters of Waterfall Cr.	56.78659	158.13443
87	Scrophulariaceae	Veronica	wormskjoldii	ssp.	wormskjoldii	small waterfall in subalpine stream feeding into Waterfall Cr., ca. 3 km NW of Joe Klutsch's Rainbow Cr. camp	56.79125	158.13074
75	Violaceae	Viola	epipsila	ssp.	repens	small stream feeding into Waterfall Cr., approximately 3 km NW of Joe Klutsch's Rainbow Cr. camp	56.78250	158.10878
206	Violaceae	Viola	epipsila	ssp.	repens	Meshik R. drainage, upper headwaters of Waterfall Cr.	56.78482	158.14034

20	Violaceae	Viola	selkirkii	shoulder of The Garden Wall ridge, 20m above terrace	56.78217	158.06171
374	Violaceae	Viola	selkirkii	Packers' Cabin, N side of bay	56.76438	157.48898
96	Aspleniaceae	Woodsia	ilvensis	S side of caldera, rock outcrop below S summit of The Garden Wall ridge	56.79570	158.04933
371	Aspleniaceae	Woodsia	ilvensis	ridge 100 m W of Packers' Cabin at mouth of Aniakchak R., just above outhouse	56.76366	157.49141
334	Potamogetonaceae	Zostera	marina	extensive tidepools below S-facing cliff on Aniakchak Bay, ca. 1.5 km E of Aniakchak R.	56.75965	157.46989

APPENDIX III

List of Alaska Natural Heritage Program rare plant ranks –

Species Global Rankings

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

Species State Rankings

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

between the two ranks.

S?: Unranked.

SU: Unrankable.

SA: Accidental.

SR: Reported from the state, but not yet verified.

SRF: Reported falsely.

SP: Potential to occur in the state.

HYB: Hybrid.

SSYN: Synonym.

Qualifiers:

B: Breeding status.

N: Non-breeding status.

?: Inexact.

Q: Questionable taxonomy.