

**STEWART RIVER TRAINING AREA
RARE PLANT SURVEY
2006**



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Abstract

Stewart River Training Area was surveyed for the presence of rare vascular plants in July 2006. A crew of four botanists surveyed all major habitats and substrates in the course of five days. A total of 155 specimens were collected, including a number of species that are rare in the state or globally. The rare species were arctic wormwood, (*Artemisia senjavinensis*; Alaska Natural Heritage Program Rank: G3-S2S3), Blaisdell's bittercress (*Cardamine blaisdellii*; G4T3T4-S2S3), mountain stitchwort (*Minuartia biflora*; G5-S3S4), Walpole's poppy (*Papaver walpolei*; G3-S3), Anvil Mountain primrose (*Primula anvilensis*; G3G4-S3S4), Greenland buttercup (*Ranunculus auricomus*; G5-S2), and matted starwort (*Stellaria dicranoides*; G3-S3). An additional species of candytuft (*Smelowskia*) may be a rare species, but determination by taxonomic experts is required. Four of these species (*A. senjavinensis*, *P. walpolei*, *Smelowskia* sp., and *Stellaria dicranoides*) were associated with barren carbonate outcrops in multiple sites in the training area. Blaisdell's bittercress (*C. blaisdellii*) and Anvil Mountain primrose (*Primula anvilensis*) were encountered frequently in wet herbaceous meadows with some ground flow of water. We collected Greenland buttercup (*R. auricomus*) in only one location, composed of few individuals, in a shrub-meadow mosaic. This species is known only from less than ten collections in North America. Fifteen other rare species may occur in the training area and we outline their typical morphology and habitat associations to assist with future inventory and monitoring efforts.

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Introduction

The Alaska Natural Heritage Program (AKNHP) conducted a vascular plant survey of the Stewart River Training Area (SRTA), a 24,160 acre site on the Seward Peninsula in northwestern Alaska owned by the Alaska Department of Natural Resources and leased and managed by Alaska Army National Guard. The site is used by civilians for subsistence, recreation, and mining activities and by the 297th Infantry Battalion for training purposes. In March 2006 an Integrated Natural Resources Management Plan was produced that outlines the need for describing the natural resources and their baseline status to ensure good stewardship as training activities continue and expand. To meet these goals, the AKNHP entered into an agreement with Alaska Army National Guard to collect and identify rare plants and note the locations, distribution and abundance of populations.

Climate, Ecology, and Geomorphology

Floristic elements are strongly influenced by the abiotic environment and here we briefly summarize climate and geologic patterns of the region. The SRTA is located roughly 23 miles north of Nome at 64° N, 165° W, along the foothills of the Kigluaik Mountains of the southern Seward Peninsula (Fig. 1). The climate is cold and windy and largely influenced by the Bering Sea. The mean annual temperature in Nome is 26.1° F, with cool summers (average July temperature is 51.1° F) and relatively moderate winters (average January temperature is 7° F). Approximately 60% of Nome's 15 inches of precipitation falls as rain. Snow covers the ground for much of the year (except June, July, and August). The growing period is similar to other low arctic locations, with few growing degree days in late May, increasing in June, climaxing in July and August, and tapering off rather quickly in September.



Figure 1. Location of the Stewart River Training Area, represented by the white square.

The Seward Peninsula is a mosaic of rugged mountain ranges, extensive hills, broad valleys, lakes, and lowlands. The geology is complex, including Precambrian metamorphics as well as recent volcanic and alluvial deposits. Glaciers shaped mountains and valleys during maximum glaciation (ca. 150,000 ybp), but were not present during the height of the Wisconsin (20,000 ybp).

The SRTA encompasses two low mountain ridges, running east-west and two river valleys. The streams are low volume with narrow floodplains (Clark 2005). Bedrock of SRTA consists of large expanses of Precambrian schist, smaller intrusions of carbonate outcrops, and mixed Quaternary deposits along the toeslopes and floodplains (Bundtzen et al. 1994). The schist is often present in the form of weathered talus slopes and barren rocky ridges. Severely weathered barren carbonate outcrops were encountered in the southwestern corner of the site and a few sites along the northern ridge. The 1-10 acre-sized outcrops were mostly composed of gravel, fines, and occasional small cliffs.

The soils are outlined in Clark (2005) and range from generally well-drained silty eolian deposits over gravel colluvium on the upper mountain slopes to poorly-drained soils over permafrost with deep organic layers on the lower mountain slopes. The floodplains and alluvial fans are generally composed of somewhat poorly drained to well-drained loamy and gravelly or sandy alluvium.

Various physical processes are important in creating habitat variation at SRTA. Solifluction lobes roughly three feet tall and 20 to 200 feet long are a distinctive feature of many of the mid-slopes in SRTA. The solifluction lobes create an abrupt transition in soil depth, saturation, and slope; generally taller grasses, sedges, and willows occupy the terminus of the lobes and mesic dwarf shrub-herbaceous tundra occur midway along the lobe. Frost boils were encountered at a

number of locations and create a barren, saturated substrate that some plant species specialize in. Peat mounds were found throughout the site adjacent to wet meadows and ponds. These formations produced modest microhabitat differentiation. High winter winds and low snow cover appear to be partially responsible for the formation and maintenance of alpine fellfields in SRTA. Permafrost is discontinuous at the site and is important in influencing the permeability of the soils and development of organic layers.

Vegetation in SRTA is typically of low arctic tundra and is described in depth in North Wind Environmental's 2002, ground cover classification. North Wind (2002) describes SRTA as having roughly 80% of its vegetation types as scrub and 20% as herbaceous. The scrub vegetation is primarily dwarf and low scrub. Tall willow shrubs occupy the floodplains and lower to mid-slopes along streams or in areas of sheet flow. Saturated graminoid meadows and wetlands are found on poorly drained toeslopes and below snowbeds. Forbs may be co-dominant at these sites as well. Mesic dwarf shrub and forb-graminoid tundra occupies much of the midslopes and sparse dwarf ericaceous tundra-graminoid vegetation is typically present on ridges. Very sparse forb-graminoid communities are present on the carbonate outcrops.

Methods

To target rare plants at SRTA we composed a list of rare or uncommon species likely to be encountered. Rarity was determined by the AKNHP's 2006 Vascular Plant Tracking list (see http://aknhp.uaa.alaska.edu/pdfs/botany/RPWG_06.pdf). A list of all vascular plants collected from the Seward Peninsula produced by the University of Alaska Museum was used to identify those species most likely to be encountered and species that would represent significant range extensions if located in SRTA.

Floristic History of SRTA

The Nome area has been visited by numerous botanists since the early 1900's and collections are not uncommon. However, only a handful of collections have occurred in the area now encompassed by SRTA. Twelve collections are listed in the University of Alaska Museum Arctos Database (2006), two from 1949 along the river and ten in 1970 at Jensen's Camp. Two of the Jensen's Camp collections are of the rare *Cardamine blaisdellii* (Blaisdell's bittercress) and numerous collections have occurred on the adjacent Mount Distin, including the rare *Papaver walpolei* (Walpole's poppy) and *Artemisia senjovensis* (arctic wormwood). North Wind Environmental, Inc. identified numerous vascular plants during their 2002 vegetation classification. None of the species listed in their commonly encountered plants includes rare taxa. However, three willow species (*Salix fuscescens*: Alaska bog willow, *S. lanata*: wooly willow and *S. phlebophylla*: skeletonleaf willow) were identified in the vegetation survey that we did not observe.

Sampling Design

To attain the goal of documenting the presence of flora of conservation concern and general floristic patterns, 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 in September 2000; the general methodology is also supported by Catling and Reznicek (2003). The reconnaissance method involves identifying survey areas within landscape units via spatial analysis using the following key criteria:

- regionally unique geological or geomorphologic features
- communities or habitats of biological concern
- likely habitats of expected species, as indicated by regional floras and herbarium 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)

Table 1. Preliminary list of potential rare species to be encountered at Stewart River. Imperiled and critically imperiled taxa are indicated in the shaded cells.

Scientific Name	Common Name	Global Rank	State Rank	Likely Habitat
<i>Aphragmus eschscholtzianus</i>	Aleutian cress	G3	S3	Moist to wet alpine screes and along snowmelt streams
<i>Artemisia globularia</i> var. <i>lutea</i>	Yellow wormwod	G4T1T2 Q	S1S2	Moist, windswept, acidic tundra. Gravel, sand, granite, mountainsides, slopes
<i>Artemisia senjavinensis</i>	Arctic wormwood	G3	S2S3	Calcereous sites, dry gravels, scree. 75-2,300ft
<i>Cardamine blaisdellii</i>	Blaisdell's bittercress	G4T3T4	S2S3	Moist tundra, creek banks, and tundra slopes.
<i>Claytonia arctica</i>	Arctic claytonia	G3	S1	Snow beds in talus, rocks, and gravels; 0-6,000 ft
<i>Douglasia alaskana</i>	Alaskan douglasia	G3	S3	Loose scree and outcrop ledges
<i>Douglasia beringensis</i>	Bering douglasia	G2	S2	Rocky slopes, outcrops and talus, 1,000-1,800 ft. Often on limestone
<i>Oxytropis czukotica</i>	Chukotka locoweed	G3?	S1?	Mountain scree and talus
<i>Papaver walpolei</i>	Walpole's poppy	G3	S3	Dry to moist calcareous screes and gravels
<i>Parrya nauruaq</i>	Nauruaq wallflower	G1G2	S1S2	Open, well-drained carbonate gravel habitats
<i>Primula anvilensis</i>	Anvil Mountain primrose	G3G4	S3S4	Low hills, damp calcereous slopes and rivers
<i>Primula tschuktschorum</i>	Chukchi primrose	G2G3	S2S3	Wet, disturbed tundra, solifluction soil
<i>Puccinellia wrightii</i>	Wright's alkaligrass	G3G4	S2S3	Wet to moist alpine slopes, heath and meadows; valleys; grus slopes, outcrops and gullies; high terraces of limestone, marblized impure carbonate, carbonate-schist substrates
<i>Ranunculus auricomus</i>	Greenland buttercup	G5	S2	Moist to wet shrub and sub-shrub tundra
<i>Ranunculus glacialis</i> var. <i>glacialis</i> (?)	Glacier buttercup	G4T2	S2	Steep rubble slopes, non-carbonate substrates
<i>Ranunculus glacialis</i> var. <i>chamissonis</i>	Chamisso's glacier buttercup	G4T3T4	S2	Moist to wet meadows and seeps
<i>Ranunculus kamchaticus</i>	Kamtchatka buttercup	G4G5	S2S3	Moist to wet disturbed soils
<i>Rumex krausei</i>	Krause's sorrel	G2	S2	Moist to wet gravels and solifluction soils. 60-1,000 ft elevation, usually on calcareous soils. Also on moist to wet sedge tundra and drier <i>Dryas</i> tundra, and river terraces
<i>Saxifraga nudicaulis</i>	Nakedstem saxifrage	G3G4Q	S2S3	Wet, disturbed tundra, solifluction soil
<i>Smelowskia johnsonii</i>	Johnson's cadytuft	G1	S1	Carbonate, dry scree
<i>Stellaria dicranoides</i>	Matted starwort	G3	S3	Rock outcrops, screes

We initially compiled a list of rare vascular plant species most likely to occur in SRTA, state and global ranks (Appendix II) and the habitats most likely encountered (Table 1.). Species with state or global imperiled ranks are shown in shaded cells.

2. We reviewed the vegetation, soil survey, and geological information and cross referenced with habitats most likely to possess the taxa of interest. Habitats of greatest interest are the following:
 - A.) Mountain fellfields and scree (especially those of calcareous substrates, i.e., Kanauguk-Rock outcrop complex, located on the southwestern border of SRTA,
 - B.) Disturbed solifluction soil, scattered throughout SRTA,
 - C.) Moist seeps and snowbeds along both mountain slopes, and
 - D.) Gravel river terraces along the Stewart River.

3. Based on this information, we used two crews of two botanists each to survey different regions of SRTA. Each crew began the day at the cantonment area and surveyed a new region, with an attempt to contact as many different habitat types and those most likely to possess rare plants. We covered the majority of the training area during the surveys and recorded daily routes using GPS or maps (Fig. 2).

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 teams of two to two AKNHP botanists (Matt Carlson, Rob Lipkin, Helen Cortes-Burns, and Irina Lapina).

Transportation to SRTA was by truck to Jensen's Camp, then ATV to the cantonment area. We traveled by foot while conducting the surveys.

At each site we conducted a complete floristic inventory using the following methods:

1. Each area was georeferenced using a Garmin GPS. Survey routes were also mapped. Representative photos were taken of each area including the plant communities, unusual landforms, and notable plants present.
2. A description of each area was recorded and significant landforms and plant associations described.
3. As new communities were encountered, the following data were recorded: vegetation type, slope, aspect, elevation, topographic position, moisture, soil types, parent material, cover classes of growth forms and bare ground, and dominant species by growth form.
4. Additional data were gathered specific to the location, habitat, etc. in which plants were collected (these collection localities are referred to as "collection sites"). The nature of data collected is discussed in the following section.

Vouchers and Curation

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 (i.e., "rare or uncommon,").

Vouchers and Curation

The following data were recorded with each vouchered specimen: date, unique collection number, latitude and longitude (NAD83, decimal degrees, taken from a handheld GPS unit); slope, aspect, elevation, topographic position, associated landforms, associated species, vegetation class, substrate, soil moisture, soil type, drainage, parent material, cover class and frequency class, notes on characters not preserved well (e.g., flower color), associated photo number, and other ecological observations. Each voucher specimen is referenced to a specific geographic locality, generally less than 1,000 m², having a uniform habitat. Collections at each site ranged from single specimens to ≥ 20 individuals. In general we would collect one or two representatives of each taxon. Multiple collections of the same taxon occurred if the taxon was found in a significantly different location or habitat type, if the taxon was of conservation significance, or if it was not easily identifiable in the field (e.g., the same species of bluegrasses and sedges were often collected multiple times).

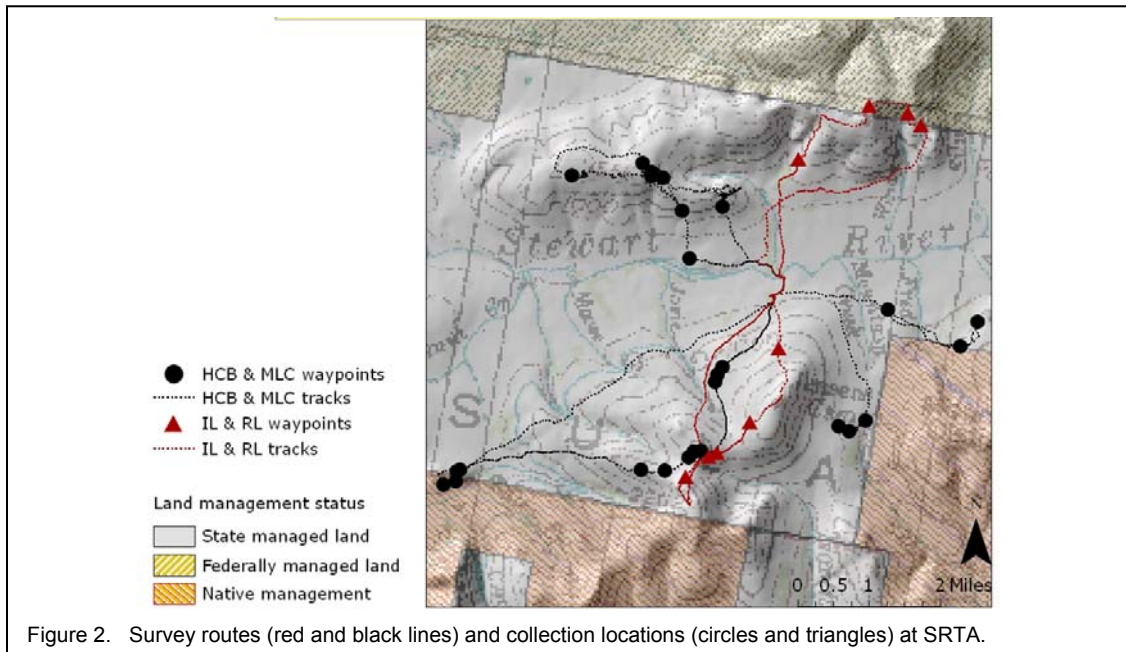
The size of the population and area surveyed was included for species of conservation concern. Population is defined here as a group of individuals of the same species (or subspecies) that occupy the same locality separated from other such groups by more than 1 km. This follows from the definition that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

The first set of collection sheets were archived at the Herbarium of the University of Alaska Anchorage. A second, duplicate, set was sent to the University of Alaska Museum (ALA) of less commonly collected species. We made a third sheet of species of conservation significance for the Army National Guard if enough material was present for an additional sheet.

Specimens were given provisional names in the field and later sorted, examined and identified by AKNHP botanists. Specimens of critical taxa will be sent to ALA for review by the museum staff.

Results and Discussion

The AKNHP surveyed most of the major substrate types, landforms, vegetation types, and covered much of the geographic extent of the SRTA (Fig. 2). The majority of collection locations were concentrated on barren mountain slopes, outcrops, and alpine ridges in fellfield, dwarf shrub, and wet herbaceous tundra. Fewer collections were made in low willow and wetland habitats, where many of the dominant plant species were not in full flower or fruit and surveying was slow and difficult. Since many of the rare species we expected to encounter were restricted to calcareous substrates, we focused one day on reaching a previously identified marble outcrop in the southwestern corner of the training area. Subsequently, we located three additional calcareous outcrops on the ridge running along the northern portion of the SRTA.



In total, we collected 155 vascular plant specimens (see Appendix I). Most of these species are widespread in Alaska or the Arctic. A number of collections, however, were of globally or regionally rare to imperiled species. No non-native species were observed in SRTA, or along the last ten miles of Glacier Creek Road.

The species that are rare globally and within the state were *Artemisia senjavinensis*, arctic wormwood (AKNHP Rank G3-S2S3; see Appendix II for an explanation of ranks), *Papaver walpolei*, Walpole’s poppy (G3-S3), and *Stellaria dicranoides*, matted starwort (G3-S3). *Primula*

anvilensis, Anvil Mountain primrose (G3G4-S3S4) has a global distribution that is restricted to the southern half of the Seward Peninsula; it was ubiquitous in moist habitats in SRTA. Three species are secure globally, but rare to imperiled in Alaska, these are *Cardamine blaisdellii* (Blaisdell's bittercress; G4T3T4-S2S3), *Minuartia biflora* (mountain stitchwort; G5-S3S4), and *Ranunculus auricomus* (Greenland buttercup; G5-S2). Of these species, *Ranunculus auricomus* (Greenland buttercup) is an extremely important find as only nine collections are known in North America outside of Greenland.

Rare Species Observed in SRTA

We encountered eight species in SRTA that are considered rare in the state and some of these are also rare globally. It is probable that we did not observe all populations of these rare species and we may have missed additional rare species that were present (we review these species in the section following this one). Here we briefly outline their habitat and distinguishing characteristics in case they are observed in SRTA the future.

Artemisia senjavinensis: Arctic wormwood (G3-S2S3)

This species was restricted to two small carbonate scree slopes along the northern ridge at upper Francisco Creek and the summit opposite of Josie Creek (Fig. 3). We did not see this species on similar screes of the marble outcrop at the southwest corner of SRTA or at the carbonate outcrop adjacent to Fred Creek.

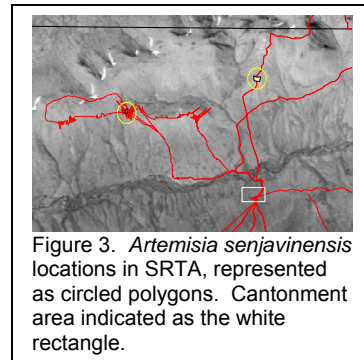


Figure 3. *Artemisia senjavinensis* locations in SRTA, represented as circled polygons. Cantonment area indicated as the white rectangle.

The site opposite Josie Creek (64.8123461°N, 165.57447458°W, 3,150 ft elev) had about 300 plants in a 150 x 30 m area (Figs. 3 and 4). Roughly 70% of the plants were vegetative; this included numerous plants less than 4 cm in diameter, as well as large plants over 15 cm in diameter. The aspect was southeast with a 10 ° slope. The substrate was dry-mesic fines below angular slabs of calcareous rocks and it co-occurred with *Dryas octopetala* (eightpetal mountain-avens), *Saxifraga oppositifolia* (purple mountain saxifrage), *Smelowskia integrifolia* (entire-leaved candytuft), *Minuartia obtusiloba* (twinflower sandwort), *Potentilla hyparctica* (arctic cinquefoil), *Carex nardina* (spike sedge), *Phlox alaskana* (Alaskan phlox), and *Oxytropis borealis* (boreal locoweed). The upper Francisco Creek site (64.82016491°N, 165.50718441°W, 1,010 ft elev) was similar in slope and aspect (southwest) and substrate, but with fewer loose angular slabs. The *A. senjavinensis* at this site was associated with *Oxytropis borealis* (boreal locoweed), *Antennaria friesiana* ssp. *alaskana* (Fries' pussytoes), *Potentilla hookeriana* (Hooker's cinquefoil), *Carex nardina* (spike sedge), *Poa glauca* (glaucous bluegrass) and the rare species *Stellaria dicranoides* (matted starwort). Approximately 50 individuals were observed in a 30 x 40 m area.

This species is restricted to sparsely vegetated calcareous substrates and more populations are not likely, as we inventoried the nearly all of these sites. However, a small intrusion of the same geologic unit (pCPzm) is present on the western edge of SRTA along the north side of the ridge that we did not survey.

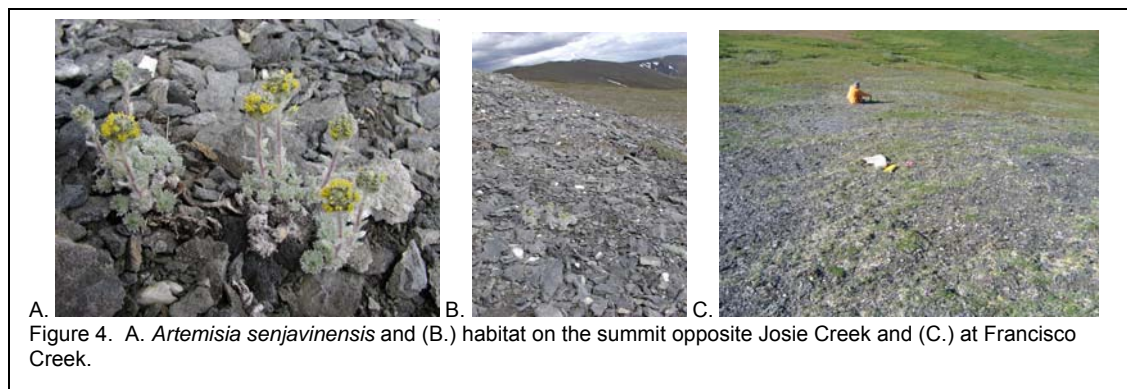


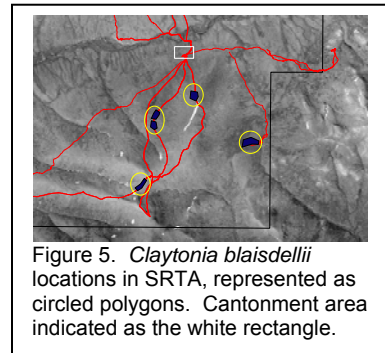
Figure 4. A. *Artemisia senjavinensis* and (B.) habitat on the summit opposite Josie Creek and (C.) at Francisco Creek.

In northwestern Alaska, this is the only densely tufted, yellow *Artemisia* (wormwood), with silky hairs on the leaves and stem.

Artemisia senjavinensis does not appear to have high population growth rates and turnover, based on the presence of very old plants (highly branched caudices with many years of old leaf bases) and lack of seedlings. Most of the plants, even large individuals, were not flowering. However, we did see numerous smaller plants, so reproduction may be episodic, and R. Lipkin has seen this species colonize disturbed materials sites near Nome.

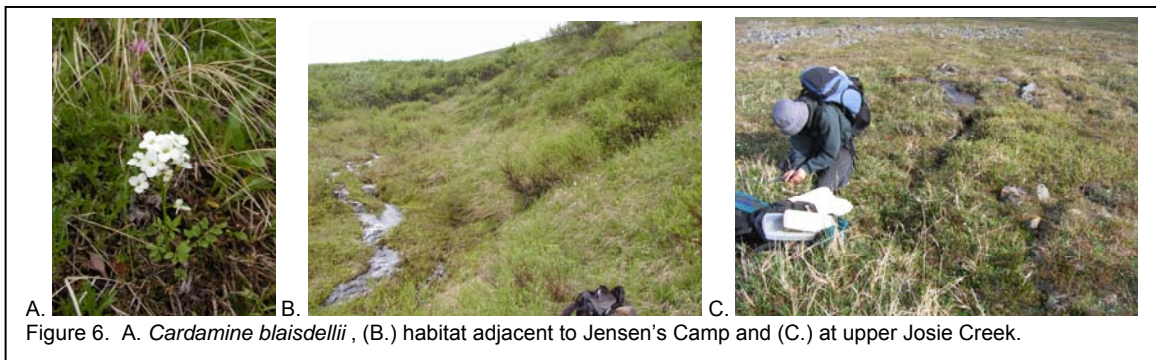
While this species can be locally abundant on the Seward Peninsula, it is greatly restricted globally. We recommend reducing or eliminating ground disturbing activities on these calcareous sites.

Cardamine blaisdellii: Blaisdell's bittercress (G4T3T4-S2S3)
We encountered *Cardamine blaisdellii* at numerous locations in SRTA: near Jensen's Camp, Upper Josie Creek, between Josie and Mountain Creeks, and Jessie Creek (Fig. 5). This species was always found in mesic to wet graminoid-forb or graminoid-*Dryas* slopes, adjacent to some flowing water (Fig. 6). In some cases it was growing next to small streams and others along saturated draining side slopes. Population sizes at three sites were roughly 50 individuals in 10 x 20 m areas, at one site more than 500 individuals were estimated in 40 x 60 m area. This species appears to be relatively short-lived, depending on frequent reproductive bouts.



This taxon is identifiable as the only *Cardamine* (bittercress) in northern Alaska with large white flowers and leaves with a large terminal lobe. It is closely related to *Cardamine microphylla* (small-leaved bittercress, with which it was synonymized by Hultén, 1968), a species of the eastern Siberian Arctic and Russian Far East, apparently also disjunct to the northeastern Alaskan arctic.

While *Cardamine blaisdellii* is restricted to the Seward Peninsula and northwestern Alaska, its population sizes are often quite large, its habitat is common, and it likely would recover quickly from most ground disturbing activities that did not significantly alter the hydrology. No special management actions are recommended for this species.

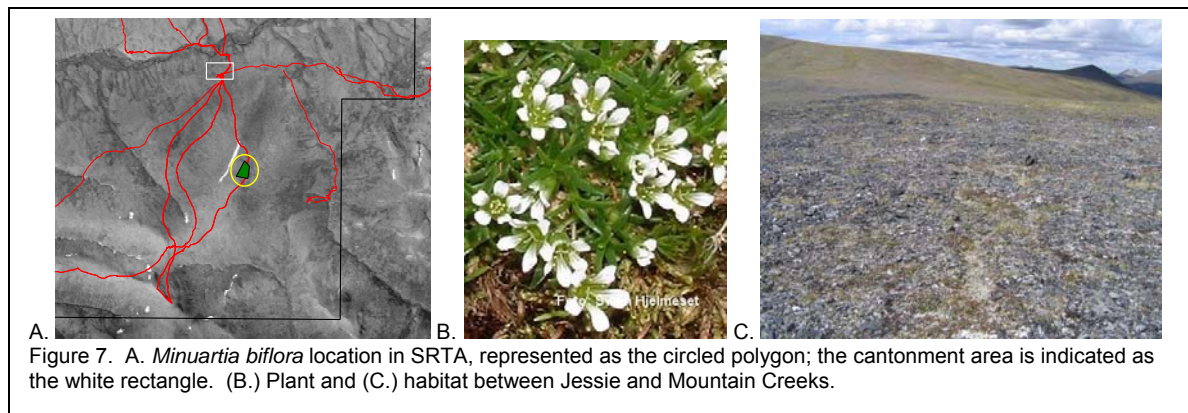


Minuartia biflora: Mountain stitchwort (G5-S3S4)
This species was collected only at a single location in SRTA on the mountain ridge between Josie and Mountain Creeks (64.78170991°N, 165.50082908 °W, 1,219 ft elev, Fig. 7). It was found on dry to moist dwarf shrub graminoid tundra of frost sorted rock stripes and nets. The associated species were *Salix rotundifolia* (least willow), *S. pulchra* (tealeaf willow), *Arctostaphylos alpina*

(alpine bearberry), *Loiseleuria procumbens* (alpine azalea), *Diapensia lapponica* (pincushion plant), *Carex microchaeta* (smallawned sedge), *Hierochloe alpine* (alpine sweetgrass), and *Luzula arcuata* (curved woodrush). Roughly 100 plants were estimated from a 30 x 30 m area. It may be more common in SRTA, but identification of *Minuartia* species is often difficult (requires collection for many species) and we did not collect all the unidentified *Minuartia* plants.

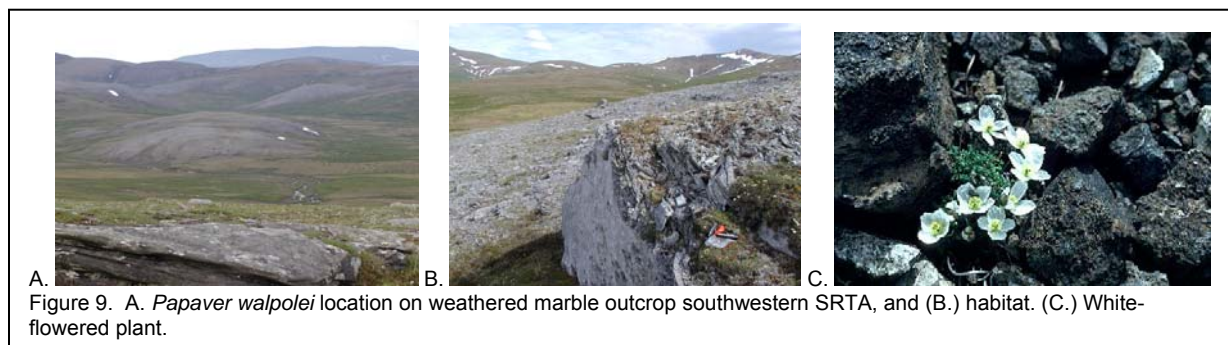
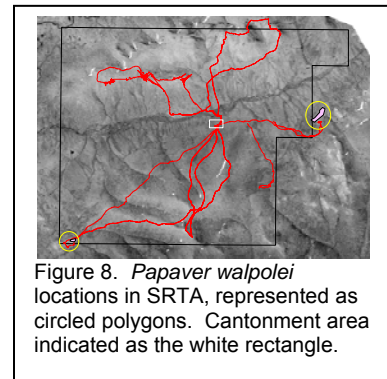
This species is distinguishable from other *Minuartia* species by a combination of traits. It is pubescent, with blunt sepal tips, three nerved leaves, small flowers, and smooth seeds.

Minuartia biflora is widespread across Alaska, but populations are quite scattered. It is not particularly threatened and no special management actions are necessary for this species.



Papaver walpolei: Walpole's poppy (G3-S3)

We observed *Papaver walpolei* at two locations in SRTA: one at a carbonate hill adjacent to Slate Creek in the southwest corner of the training area (64.74621573°N, 165.63983523°W, 614 ft elev, Fig. 8), and one along the eastern border and to the outside of the training area at the north ridge of Mount Distin above Boulder Creek (64.78838149°N, 165.41555948°W, 871 ft elev). We did not observe this poppy at the higher elevation carbonate outcrops along the northern ridge. The population along Slate Creek was on a modest slope of well-drained, exposed gravel to rock slab-sized marble colluvium (Fig. 9). The associated species at Slate Creek were *Carex microchaeta* (smallawned sedge), *Saxifraga oppositifolia* (purple mountain saxifrage), *Minuartia rossii* (Ross' sandwort), *Carex rupestris* (curly sedge), *Dryas integrifolia* ssp. *integrifolia* (entireleaved mountain-avens), *Cassiope tetragona* (white arctic mountain heather), *Parrya nudicaulis* (nakedstem wallflower), and *Lloydia serotina* (common alplilly). At Boulder Creek the associates were *Dryas octopetala* (eightpetal mountain-avens), *Cassiope tetragona* (white arctic mountain heather), *Silene acaulis* (moss campion), *Carex scirpoidea* (northern singlespike sedge), *Packera cymbalaria* (dwarf arctic ragwort), *Pinguicula vulgaris* (common butterwort), *Arnica frigida* (snow arnica), *Anemone drummondii* (Drummond's anemone),



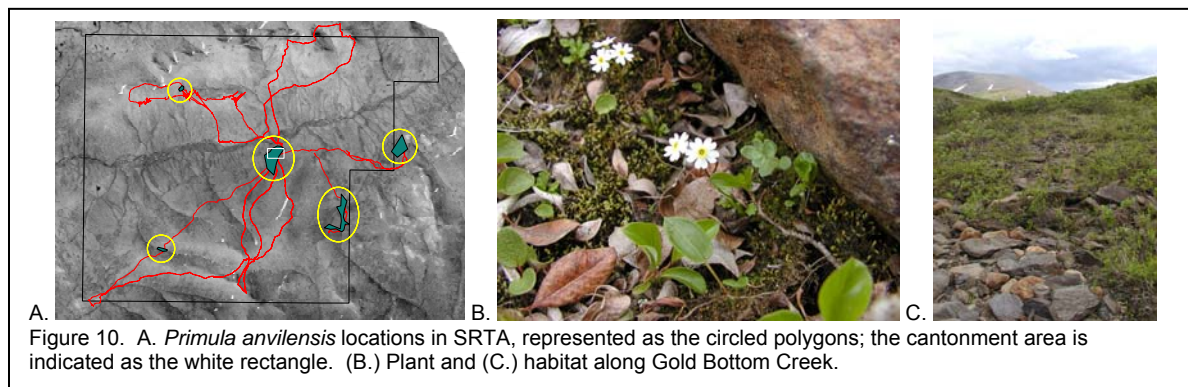
Saxifraga oppositifolia (purple mountain saxifrage), *Eritrichium aretioides* (arctic alpine forget-me-not), and *Primula anvilensis* (Anvil Mountain primrose). At Slate Creek the population was composed of roughly 100 individuals scattered over a large area (75 x 150 m) on the northern side of the hill. At Boulder Creek we estimated approximately 100 individuals over 60 x 30 m.

This species of poppy can be composed of both white and light yellow-flowered individuals. The Slate Creek population was entirely yellow-flowered. This species can be distinguished from other poppies in the area in having non-pubescent three-lobed leaves that bend under at the edges, and a short stature, less than 20 cm in height.

Papaver walpolei is principally restricted to the western tip of Chukotka and the Seward Peninsula. It is also found at scattered locations in the Ahklun Mountains, western Brooks Range, northeast Alaska and the Yukon Territory. More than 30 populations are known from the Seward Peninsula and this species is not particularly threatened. It is, however, a narrow habitat specialist on exposed carbonate substrates that also tend to have other unusual and rare species; reducing activities on carbonate outcrops is advised.

Primula anvilensis: Anvil Mountain primrose (G3G4-S3S4)

The Anvil Mountain primrose was observed throughout SRTA on moist to saturated graminoid-forb or streamside habitats from low to high elevations (Fig. 10). It was not observed in low sedge/cottongrass-wetlands, thick shrublands, or well-drained mountain slopes and ridges, however. Associated species include *Salix alaxensis* (felleaf willow), *Salix pulchra* (tealeaf willow), *Salix reticulata* (netleaf willow), *Equisetum arvense* (field horsetail), *Potentilla fruticosa* (shrubby cinquefoil), *Vaccinium uliginosum* (bog blueberry), *Calamagrostis Canadensis* (bluejoint), *Rubus arcticus* (arctic blackberry), *Rhodiola integrifolia* (ledge stonecrop), *Equisetum variegatum* (variegated scouringrush), *Polemonium acutiflorum* (tall jacob's-ladder), *Anemone richardsonii* (yellow thimbleweed), *Carex lugens* (spruce muskeg sedge), and *Juncus castaneus* (chestnut rush). Populations tended to be composed of hundreds to thousands of individuals scattered over large areas. This species is clearly short-lived and undergoes rapid turnover, suggesting that populations are not as sensitive to perturbation and can respond quickly. This species is composed of two different morphological types that are presumably accompanied by a strong self and within-morph incompatibility system (i.e., distyly, see Kelso 1987), making this species reliant on high pollinator visitation for fruit and seed production. However, the small flowers and low numbers of pollinators (even in good weather) suggest that the reproductive system may not be typical of most distylous species. This reproductive system is believed to be very rare in the Arctic and more research is warranted on this subject.

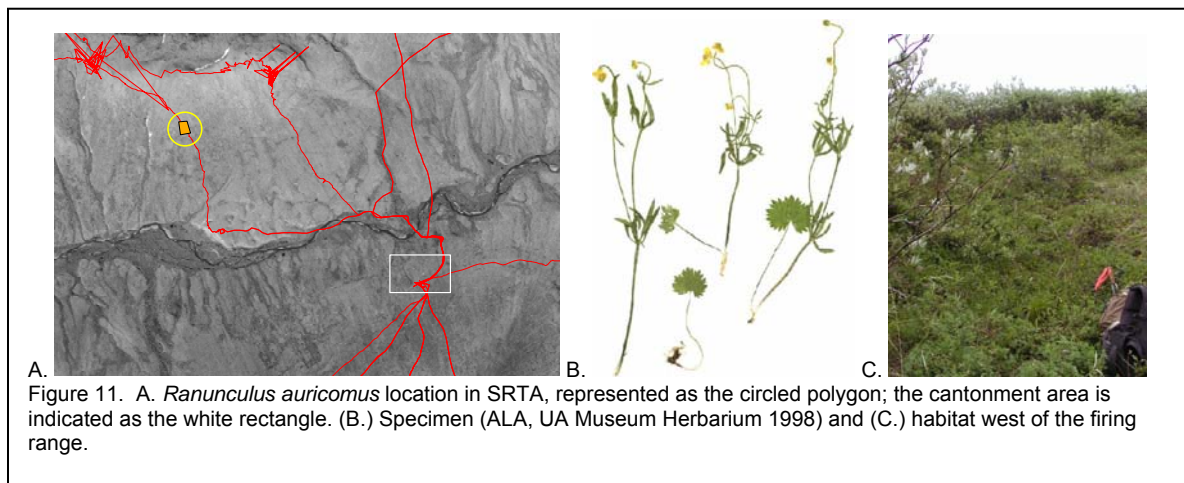


This species is the only small and delicate white flowered-primrose with toothed leaves lacking powdery farina (see Kelso 1987).

The Anvil Mountain Primrose is another species restricted to the Seward Peninsula and western Brooks Range. Unlike Walpole's Poppy, however, it is not limited to an uncommon habitat type and no special conservation considerations are necessary.

Ranunculus auricomus [aggregate]: Greenland buttercup (G5-S2)

One of the more noteworthy finds was of *Ranunculus auricomus*. We collected this species at a single site west of the firing range (64.80576203°N, 165.55719981°W, 999 ft elev) in a side slope draw of low shrub-forb tundra (Fig. 11). The plants were growing between willows in mesic thick turf over loam. The associated species were *Salix alaxensis* (feltleaf willow), *Salix hastate* (halberd willow), *Potentilla fruticosa* (shrubby cinquefoil), *Dryas alaskana* (Alaska mountain-avens), *Solidago multiradiata* (Rocky Mountain goldenrod), *Viola biflora* (arctic yellow violet), *Arctostaphylos alpine* (alpine bearberry), and *Festuca altaica* (Altai fescue).



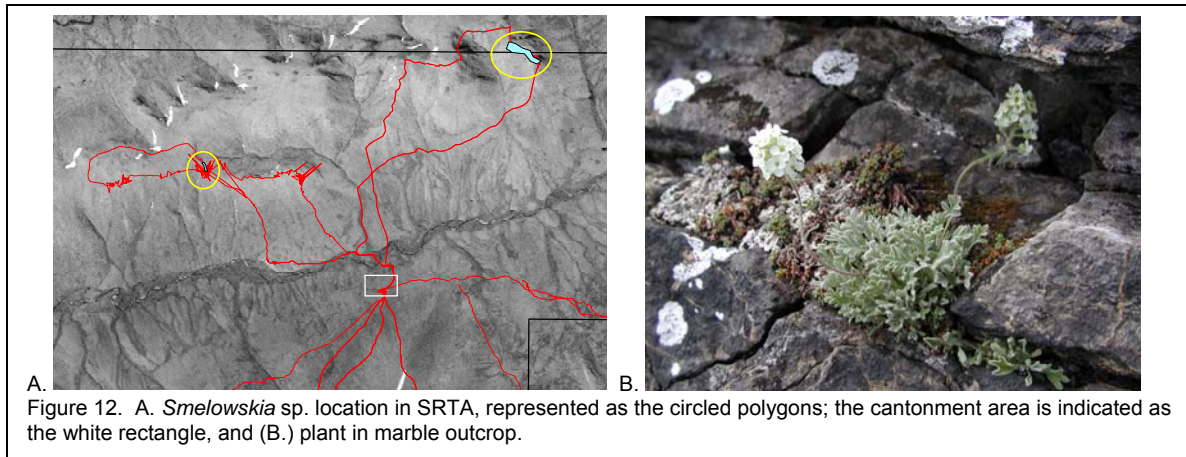
The population was composed of approximately 20 individuals in a 15 x 15 m area. It is possible that this species is found at other locations in the shrub zone along either side of the Stewart River. Individuals are difficult to detect in the thick brush and we did not survey much of the willow shrublands adjacent to the Stewart River.

Ranunculus auricomus is quite similar to *R. pedatifidus* ssp. *affinis* (northern buttercup) that is known throughout northern Alaska. However, *R. auricomus* has a distinctively round and toothed lower leaf (Fig. 11), as opposed to a deeply lobed basal leaf.

This species is part of a difficult complex of buttercups with a primarily Eurasian distribution, and with a few collections known from Greenland and western Alaska. In Alaska it is known from the Seward Peninsula, lower Noatak, and Nulato Hills. The collections from the Seward Peninsula include collections at Bluff, 50 miles east of Nome, Salmon Lake, and along the Teller Road at Arctic and Cleveland Creeks. All collections were from dense willow shrublands.

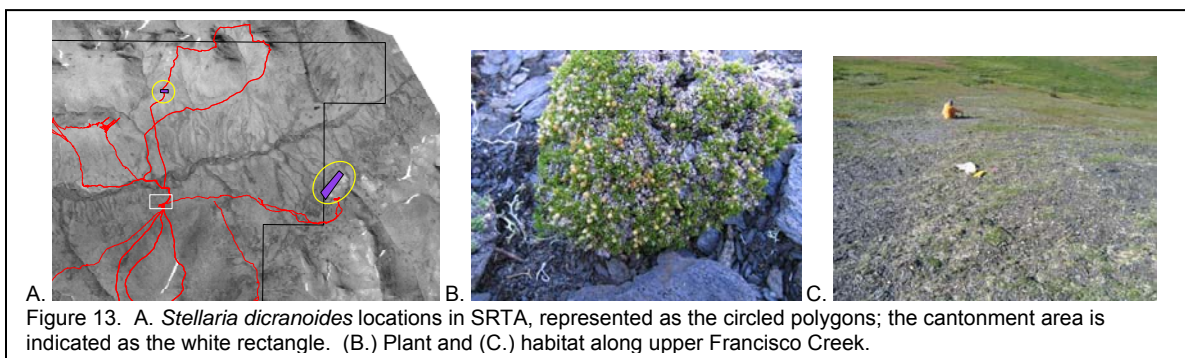
Smelowskia species: Candytuft (potentially *S. calycina* var. *media*: G3G2Q-S3S2)

A *Smelowskia* was collected at two of the calcareous outcrops (64.83320137°N, 165.45949238°W, 1,615 ft elev and 64.81162936°N, 165.57429831°W, 1,428 ft elev) that appears to be distinct from the more common *Smelowskia calycina* var. *integrifolia* (Fig. 12). This taxon may be the globally and regionally rare *Smelowskia calycina* var. *media*, but requires review by taxonomic experts. We are sending these specimens to Dr. Dave Murray of the University of Alaska Museum and we will inform the Guard of the final determinations. Likely hundreds of individuals were present on the upper Francisco Creek population.



Stellaria dicranoides: Matted starwort (G3-S3)

We observed *Stellaria dicranoides* at two calcareous outcrops in SRTA. Both sites were where other rare plants were collected. One site was at the north ridge of Mount Distin above Boulder Creek (64.78838149°N, 165.41555948°W, 871 ft elev) and the other was at the upper reaches of Francisco Creek (64.82016491°N, 165.50718441°W, 1,010 ft elev, Fig. 13). The substrate and habitat at the Francisco Creek site was of a dry open dwarf shrub graminoid fellfield on a southwest facing carbonate rubble slope. At Boulder Creek a sparsely vegetated carbonate ridge with a dry dwarf shrub-forb plant association, where the plants were growing on frost shattered marbleized limestone. The plants associated with this species were *Anemone drummondii* (Drummond's anemone), *Arnica frigida* (snow arnica), *Cassiope tetragona* (arctic white mountain heather), *Carex glacialis* (glacial sedge), *Carex scirpoidea* (northern singlespike sedge), *Dryas octopetala* (eightpetal mountain-avens), *Eritrichim aretioides* (arctic alpine forget-me-not), *Festuca altaica* (Altai fescue), *Papaver walpolei* (Walpole's poppy), *Phlox alaskana* (Alaskan phlox), *Pinguicula vulgaris* (common butterwort), *Potentilla uniflora* (oneflower cinquefoil), *Primula anvilensis* (Anvil Mountain primrose), *Saxifraga oppositifolia* (purple mountain saxifrage), *Packera cymbalaria* (dwarf arctic ragwort), and *Silene acaulis* (moss campion). Population sizes were only a few individuals observed at Boulder Creek, while at upper Francisco Creek fewer than 30 individuals were observed. This appears to be a long-lived species with few seedlings recruited in any year, so that responses to population reductions would be slow.



This is a characteristic and unusual *Stellaria* species that forms a dense cushion and lacking petals. The generic placement of this species is unclear and it has been treated within *Arenaria* (as *A. chamissonis*) as well as *Stellaria*. Recent work suggests it may best be treated within a separate genus of its own.

This species is found over much of central and northern Alaska in the mountains. Populations tend to be small and scattered. While this species is not a calciphile, the majority of collections in Alaska are from more basic rock types.

As with *Artemisia senjavinensis* and *Papaver walpolei* we recommend limiting activities that disturb the ground of these sites.

Rare Species Not Encountered in SRTA

We did not encounter a number of rare species that we expected or that were likely. It is possible these species are present in the SRTA in regions we did not survey or where not detected. Here we briefly outline their habitat and distinguishing characteristics in case they observed in SRTA the future.

Aphragmus eschscholtzianus: Aleutian cress

This is an uncommon mustard (Brassicaceae) of moist screes and snowmelt streams (Fig. 14). It is found in the Aleutians, Alaska Range, Chugach Mountains, and a few outlying collections in the Brooks Range and western Seward Peninsula. The collections from the Seward Peninsula are both from calcareous substrates, one from the Sinuk uplands, 10 miles NNE of Cape Rodney on marbleized moist gravels, and the other from Cape Prince of Wales on a limestone solifluction slope. Populations are typically small but can be locally common in dense patches of hundreds of plants. This species is easily distinguished by its dwarfed stature, spatulate-ovate leaves, long underground petioles, small white to purplish flowers, and oblong to elliptic fruits.

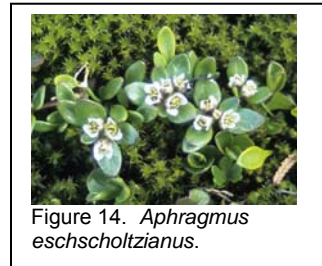


Figure 14. *Aphragmus eschscholtzianus*.

Artemisia globularia var. *lutea*: Yellow wormwood

This taxon is endemic to the western Seward Peninsula and to islands in the Bering Sea (St. Matthew, St. Lawrence and St. Paul). On the Seward Peninsula *Artemisia globularia* var. *lutea* is found on rocky schist and granitic mountain slopes and ridges near Crete Creek in the Kigluaik Mountains. This taxon is distinguished from other Alaskan *Artemisias* in being caespitose, yellow-flowered (with glabrous corollas), and with leaves lacking the thick silky hairs of *A. senjavinensis* (Fig. 15).

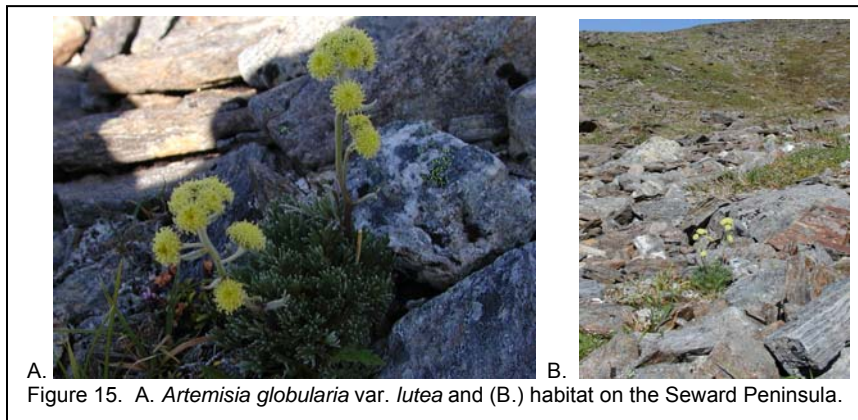


Figure 15. A. *Artemisia globularia* var. *lutea* and (B.) habitat on the Seward Peninsula.

Claytonia arctica: Arctic claytonia

This rare, white-flowered *Claytonia* species is known in North America from only a few collections in the Aleutian and Bering Sea Islands and a single location and on the Seward Peninsula at the Tin City Long Range Radar Site. It resembles *Claytonia sarmantosa*, but has a well-developed taproot and white flowers with a yellow basal spot and lacks pink veins (Fig. 16). The habitat of this species from the Seward Peninsula site was a

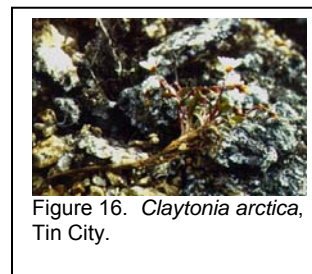


Figure 16. *Claytonia arctica*, Tin City.

steep southwest-facing slope in dry scree and blocky talus that was sparsely vegetated, principally with *Luzula multiflora*. Population sizes at this location were occasional to locally common.



Figure 17. *Douglasia alaskana*.



Figure 18. *Douglasia beringensis*.

Douglasia alaskana: Alaskan douglasia

Douglasia alaskana is scattered across southern Alaska from the Kenai Mountains and Alaska Peninsula to the Seward Peninsula (at Birch Creek) in mountain scree habitats. This species is not particularly imperiled, but populations are relatively few and scattered and usually small. This is an early flowering biennial species that is easily overlooked. It flowers early with a dense cushion of pink flowers. The pedicels of the flowers rapidly elongate after flowering forming a distinctive arrangement in fruit (Fig. 17).

Douglasia beringensis: Bering douglasia

This species differs from *D. alaskana* in its perennial habit, cushion growth form and with leaves and the upper stems and sepals having a dense pubescence of stellate hairs (Fig. 18). It is known from a few collections on the Seward Peninsula in the hills south of Deering and the uplands north of the Sinuk River. Outside of the Seward Peninsula it is known from the Nulato Hills, the Lime Hills and the Kokrines Hills and is rare. The habitat of *D. beringensis* is of outcrops and ridges and screes in the mountains, typically (but not exclusively) on limestone. We expected that this species might be found on the marbled outcrops of SRTA.

Oxytropis czukotica: Chukotka locoweed

Oxytropis czukotica (Fig. 19) is an eastern Siberian taxon with affinities to the *O. nigrescens* complex. *Oxytropis czukotica* has been reported from isolated locations in western Alaska, but it is unclear, what its range is in Alaska and how it is distinguished. Its habitat preferences appear to mirror that of *O. nigrescens*, which is rocky, barren mountain slopes.



Figure 19. *Oxytropis czukotica* specimen (Missouri Botanic Garden 2006).

Parrya nauruaq: Nauruaq wallflower

A new species of *Parrya* was recently discovered in the weathered marbled gravel and outcrop, badlands north of the Sinuk River on the Seward Peninsula, where population sizes are relatively large. It appears that it is only known from the Seward Peninsula. This species is closely related to the widespread *Parrya nudicaulis*, but differs in having much smaller flowers (petals 6-7mm long) that are pale violet, with a distinct musky smell and with thicker, fleshy leaves in a dense basal rosette (Fig. 20). It is possible that this species may be found on barren carbonate outcrops of SRTA.



Figure 20. *Parrya nauruaq*.

Primula tschuktschorum: Chukchi primrose

The Chukchi primrose is a moderately rare species of the Bering Strait Region, with numerous populations found on the Seward Peninsula in the low hills and mountains. This species is found on saturated to moist soils, generally with some movement of water through the soils, and on more open microsites, such as frost boils and solifluction lobes. This is the only primrose without notched petals and that also lacks powdery farina on the basal leaves and upper scape (Fig. 21). While we did not locate any *Primula tschuktschorum* in SRTA, we did see a number of populations of its close relative *P. eximia*. *Primula eximia* is relatively common across Alaska, often occupies the same habitat, and is



Figure 21. A. *Primula tschuktschorum* and (B.) habitat in the Bendeleben Mountains.

distinguishable from the rare species in having farina on the leaves and scape, wider leaves, anthers and stigmas borne at the same level, and smaller, more numerous flowers.



Figure 22. *Puccinellia wrightii* (ALA specimen).

Puccinellia wrightii: Wright's alkaligrass

This is a rare grass (Fig. 22) of northwestern Alaska. It grows in saturated to moist sands and gravels of maritime and river terraces and valleys in the mountains, often on basic substrates

Ranunculus glacialis var. (*glacialis*?): Glacier buttercup

This taxon may be the European *Ranunculus glacialis* var. *glacialis* (synonym = *Beckwithia glacialis*), and if so, the plants from western Alaska are very widely disjunct from Europe. Otherwise, it may be a new and undescribed taxon, endemic only to the Kigluaik Mountains. Regardless, this plant is extremely rare in North America. We observed this species on loose rocky slopes of slabs of schist at a site 15 miles west of SRTA along Crete Creek off the Teller Highway. It is

known from seven sites, several of which have thousands of individuals, associated with sparsely vegetated high-alpine non-carbonate rubble slopes and screes. This is a very recognizable species; it is the only terrestrial *Ranunculus* with white flowers (tinged red) and lobed leaves are spreading rather than ascending.

Ranunculus glacialis var. *chamissonis*: Chamisso's glacier buttercup

Fifteen localities are known for this taxon in Alaska, almost all in westernmost Alaska. It has been described as abundant in two Alaskan sites. It has so far been found in the Seward Peninsula, St. Lawrence Island, Ray Mountains, White Mountains, and the Alaska Range (Denali National Park). As with *Ranunculus glacialis* var. *glacialis*, this taxon has white flowers and leaves with ascending lobes (Fig. 23).

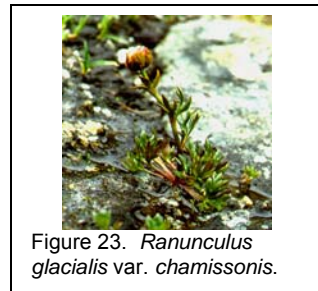


Figure 23. *Ranunculus glacialis* var. *chamissonis*.

Ranunculus kamchaticus: Kamchatka buttercup

The Kamchatka buttercup (synonym = *Oxygraphis glacialis*) is an Asian species, that is also found in western Alaska, with scattered locations extending as far east as the central Alaska Range. It is usually found on limestone or carbonate gravels on terraces and slopes in shallow seepage zones. This is a small white *Ranunculus* with simple, toothed, fleshy leaves and the only representative of this section of *Ranunculus* in Alaska (Fig. 24).

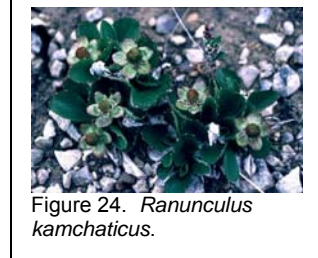


Figure 24. *Ranunculus kamchaticus*.



Figure 25. *Rumex krausei*.

Rumex krausei: Krause's sorrel

This rare *Rumex* is endemic to eastern Chukotka and northwest Alaska. It is known from a few locations on the Seward Peninsula, one at the Sinuk River lowlands on moist, marbled substrates and collections from the Lost River on saturated carbonate gravels.. This is a small *Rumex* species with separate male and female plants, narrow leaves, stolons, and dense inflorescences (Fig. 25). Additionally, it has entire stipules and it has a capitate unbranched inflorescence.



Figure 26. *Saxifraga nudicaulis*.

Saxifraga nudicaulis: Nakedstem saxifrage

Saxifraga nudicaulis is a species restricted to the Seward Peninsula and Chukotka, and is found on wet, disturbed ground, such as mud boils, solifluction soil, and stream and lake margins. It can be relatively abundant in some sites on the Seward Peninsula and is probably not a species of great conservation significance. *Saxifraga nudicaulis* is

distinguishable from other *Saxifraga* by broad, toothed lower leaves, a naked scape, and calyx lobes that are erect rather than reflexed (Fig. 26).

Smelowskia johnsonii: Johnson's candytuft

Smelowskia johnsonii is a poorly understood taxon, known only from three collections, which differs from other species in the genus by having oblong to ovate, entire or shallowly toothed stem leaves that are covered with long, unbranched, white-villous hairs (see Mulligan 2001). It is known from the hills adjacent to the Kukpuk River and Flint Hills near Cape Lisburne, and the Lost River on the Seward Peninsula.

Conclusion and Recommendations

We observed seven rare vascular plants in SRTA. Four species were globally restricted to northwestern Alaska, one species is widespread globally but extremely rare in North America. None of the rare species have any legal protection under the U.S. Endangered Species Act of 1973. None of these species are in immediate danger of extirpation in Alaska, but they do represent an important natural resource of SRTA and the Seward Peninsula.

Despite the small size of the SRTA, it contains a large variety of habitat types and surficial geologies, which contribute to a rich rare flora. The majority of rare species (*Artemisia senjavensis*, *Papaver walpolei*, *Stellaria dicranoides* and the undetermined *Smelowskia*) were concentrated on carbonate intrusions of weathered marble on the northern ridge, and southwest and eastern corners of the training area. These intrusions were generally quite small (roughly 0.5 to 5 acres) and widely scattered. Schists dominate the majority of the mountain slopes and ridges and only the moderately rare *Minuartia biflora* was observed on this rock type. Two species (*Cardamine blaisdellii* and *Primula anvilensis*) were associated with small flowing water along side slopes. Both of these species were extremely abundant in SRTA and do not require special management. Last, open willow shrublands housed a population of the regionally rare buttercup *Ranunculus auricomus*.

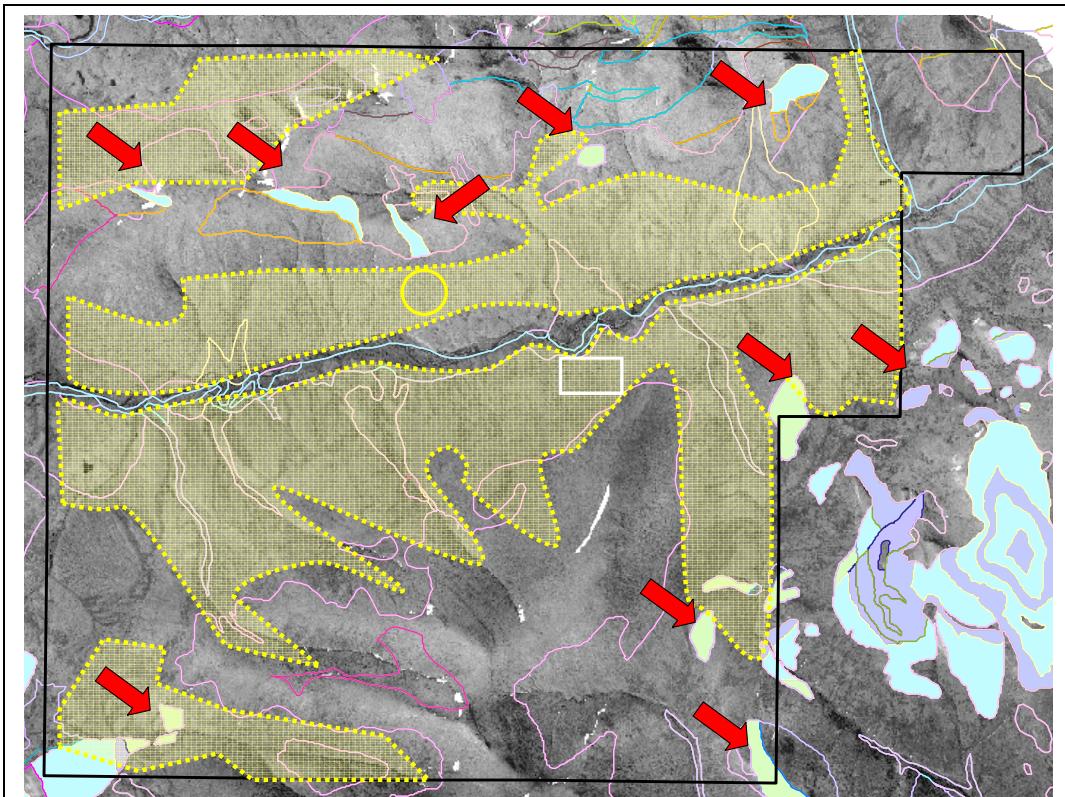


Figure 27. Carbonate outcrops are indicated with red arrows. Potential habitat of the rare *Ranunculus auricomus*.

We suggest that all the carbonate outcrops in SRTA are protected from earthmoving activities that may disturb populations that are not able to recover quickly. Additionally, we suggest that more intensive surveys for *Ranunculus auricomus* occur in shrublands adjacent to the Stewart River (see Fig. 27).

Additionally, we recommend that ecological studies to understand the reproductive behavior, habitat associations, and demographic status of these species be undertaken. This information is woefully lacking for nearly all rare vascular plants in the state and will greatly assist SRTA and other land managers in understanding how to minimize impacts, where activities are acceptable, and the effects those activities will have on the biological resources they are charged with managing.

Acknowledgements

Emerson Krueger of the Army National Guard offered considerable help with logistics, planning, and background information about the training area.

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Appendix I

Name	Global_Rank	State_Rank	Latitude	Longitude	Elev (ft)	Habitat	Number
<i>Androsace chamaejasme</i>			64.75845306	-165.5285334	1705	alpine slope, dwarf shrub-	2006-012
<i>Androsace septentrionalis</i>			64.74268477	-165.6464114	643	exposed gravelly knob, rock	2006-043
<i>Anemone drummondii</i>			64.74621573	-165.6398352	614	exposed gravelly slope	2006-034
<i>Anemone drummondii</i>			64.83320137	-165.4594924	1615	dry screes and outcrops with	2006-118
<i>Antennaria friesiana</i> ssp. <i>alaskana</i>			64.75802047	-165.5318056	1786	alpine summit outcrop in dryas-	2006-025
<i>Antennaria friesiana</i> ssp. <i>alaskana</i>			64.82016491	-165.5071844	1010	dry open dwarf shrub graminoid	2006-109
<i>Antennaria monocephala</i> ssp.			64.75802047	-165.5318056	1786	alpine summit outcrop in dryas-	2006-024
<i>Armeria maritima</i>			64.74376042	-165.6409385	698	exposed gravelly knob	2006-045
<i>Arnica frigida</i>			64.80794258	-165.5384632	989	fellfield, ground squirrel	2006-126
<i>Arnica frigida</i>			64.80794258	-165.5384632	989	fellfield, ground squirrel	2006-127
<i>Artemisia arctica</i>			64.83320137	-165.4594924	1615	moist herbaceous meadow	2006-123
<i>Artemisia senjavinensis</i>	G3	S2S3	64.82016491	-165.5071844	1010	dry open dwarf shrub graminoid	2006-106
<i>Artemisia senjavinensis</i>	G3	S2S3	64.8123461	-165.5744746	3150	exposed mountain ridge	2006-143
<i>Astragalus australis</i>			64.82016491	-165.5071844	1010	dry open dwarf shrub graminoid	2006-113
<i>Astragalus umbellatus</i>			64.80891212	-165.6118571	1455	broad mountain ridge, fellfield	2006-141
<i>Boykinia richardsonii</i>			64.75845306	-165.5285334	1705	alpine slope, dwarf shrub-	2006-011
<i>Braya glabella</i>			64.74570989	-165.6410986	667	exposed gravelly knob	2006-039B
<i>Braya glabella</i>			64.79392611	-165.40969	871	sparsely vegetated carbonate ridge	2006-097
<i>Bromus pumpeianus</i> var.			64.82016491	-165.5071844	1010	dry open dwarf shrub graminoid	2006-107
<i>Calamagrostis purpurascens</i>			64.82016491	-165.5071844	1010	dry open dwarf shrub graminoid	2006-108
<i>Cardamine bellidifolia</i>			64.76376234	-165.461037	660	steep schist/shale outcrop	2006-085
<i>Cardamine bellidifolia</i>			64.78838149	-165.4155595	871	ericaceous dwarf shrub tundra	2006-094
<i>Cardamine blaisdellii</i>	G4T3T4	S2S3	64.77432394	-165.5273099	1126	sideslope, base of solifluction	2006-007
<i>Cardamine blaisdellii</i>	G4T3T4	S2S3	64.78170991	-165.5008291	1219	mossy snowbed with rocky	2006-052
<i>Cardamine blaisdellii</i>	G4T3T4	S2S3	64.76809977	-165.4662076	726	small creek drainage, graminoid-	2006-080
<i>Cardamine pratensis</i>			64.79323553	-165.4526014	579	moist to wet hummocky low	2006-092
<i>Carex glacialis</i>			64.79392611	-165.40969	871	sparsely vegetated carbonate ridge	2006-098
<i>Carex lachenellii</i>			64.80794258	-165.5384632	989	fellfield, ground squirrel	2006-129
<i>Carex lugens</i>			64.75662556	-165.5339454	1672	moist graminoid-dryas tundra	2006-027
<i>Carex lugens</i>			64.79323553	-165.4526014	579	moist to wet hummocky low	2006-090
<i>Carex membranacea</i>			64.81393958	-165.5794562	1566	mountain ridge, wet graminoid-	2006-136
<i>Carex nardina</i>			64.82016491	-165.5071844	1010	dry open dwarf shrub graminoid	2006-111
<i>Carex nardina</i>			64.81162936	-165.5742983	1428	mountain ridge, fellfield, rock	2006-132
<i>Carex petricosa</i> var. <i>petricosa</i>			64.74376042	-165.6409385	698	exposed gravelly knob	2006-042
<i>Carex podocarpa</i>			64.76809977	-165.4662076	726	small creek drainage, graminoid-	2006-082
<i>Carex rariflora</i>			64.77029258	-165.4541601	586	cobbly stream bed, willow-forb	2006-075
<i>Carex rupestris</i>			64.74621573	-165.6398352	614	exposed gravelly slope	2006-037
<i>Carex rupestris</i>			64.79392611	-165.40969	871	sparsely vegetated carbonate ridge	2006-099
<i>Carex scirpoides</i>			64.74570989	-165.6410986	667	exposed gravelly knob	2006-041
<i>Carex vaginata</i>			64.79323553	-165.4526014	579	moist to wet hummocky low	2006-089
<i>Carex williamsii</i>			64.74376042	-165.6409385	667	exposed gravelly knob	2006-046
<i>Claytonia eschscholtzii</i>			64.75318068	-165.5436557	1548	sideslope, saturated graminoid	2006-030
<i>Claytonia eschscholtzii</i>			64.81160405	-165.568863	1272	sideslope, mesic-wet graminoid-	2006-130
<i>Claytonia sarmentosa</i>			64.77029258	-165.4541601	586	stream margin, wet meadows	2006-153
<i>Claytonia tuberosa</i>			64.74376042	-165.6409385	667	exposed gravelly knob	2006-047
<i>Claytonia tuberosa</i>			64.81160405	-165.568863	1272	sideslope, mesic-wet graminoid-	2006-131
<i>Corydalis pauciflora</i>			64.75863143	-165.5209979	1504	moist, to seasonally wet,	2006-058
<i>Crepis nana</i>			64.81162936	-165.5742983	1428	mountain ridge, fellfield, rock	2006-134
<i>Dodecatheon frigidum</i>			64.77029258	-165.4541601	586	stream margin, wet meadows	2006-152
<i>Draba aff. lactea</i>			64.83320137	-165.4594924	1615	unstable talus barrens and rubble	2006-120
<i>Draba alpina</i>			64.75845306	-165.5285334	1705	alpine slope, dwarf shrub-	2006-020
<i>Draba alpina</i>			64.75662556	-165.5339454	1672	moist graminoid-dryas tundra	2006-029
<i>Draba alpina</i>			64.75284959	-165.5339804	1756	moist to wet forb graminoid	2006-074
<i>Draba alpina</i>			64.83320137	-165.4594924	1615	unstable talus barrens and rubble	2006-121
<i>Draba borealis</i>			64.75845306	-165.5285334	1705	alpine slope, dwarf shrub-	2006-022
<i>Draba borealis</i>			64.75863143	-165.5209979	1504	moist, to seasonally wet,	2006-060
<i>Draba borealis</i>			64.75863143	-165.5209979	1504	moist, to seasonally wet,	2006-061
<i>Draba cf. palanderiana</i>			64.75284959	-165.5339804	1756	moist overhangs and ledges of	2006-068B
<i>Draba cf. palanderiana</i>			64.75284959	-165.5339804	1756	moist overhangs and ledges of	2006-072
<i>Draba fladruzensis</i>			64.75845306	-165.5285334	1705	alpine slope, dwarf shrub-	2006-018

Appendix I, continued

Name	Global_Rank	State_Rank	Latitude	Longitude	Elev (ft)	Habitat	Number
<i>Draba fladrizensis</i>			64.75284959	-165.5339804	1756	moist overhangs and ledges of	2006-071
<i>Draba hirta</i>			64.75845306	-165.5285334	1705	alpine slope, dwarf shrub-	2006-021
<i>Draba lactea</i>			64.79392611	-165.40969	871	sparsely vegetated carbonate ridge	2006-104
<i>Draba longipes</i>			64.75662556	-165.5339454	1672	moist graminoid-dryas tundra	2006-028
<i>Draba nivalis</i>			64.75845306	-165.5285334	1705	alpine slope, dwarf shrub-	2006-019
<i>Draba nivalis</i>			64.75284959	-165.5339804	1756	moist overhangs and ledges of	2006-068A
<i>Draba stenopetala</i>			64.83320137	-165.4594924	1615	dry screes and outcrops with	2006-117
<i>Elymus alaskanus</i> ssp. <i>alaskanus</i>			64.74268477	-165.6464114	643	exposed gravelly knob, rock	2006-051
<i>Equisetum variegatum</i>			64.77599513	-165.5254081	1102	sideslope, mesic dwarf	2006-006
<i>Erigeron humilis</i>			64.76757634	-165.461037	660	steep schist/shale outcrop	2006-083
<i>Eritrichium aetioideis</i>			64.79392611	-165.40969	871	sparsely vegetated carbonate ridge	2006-100
<i>Eritrichium</i> cf. <i>arterioides</i>			64.74621573	-165.6398352	614	exposed gravelly slope	2006-033
<i>Eutrema edwardsii</i>			64.77599513	-165.5254081	1102	sideslope, mesic dwarf	2006-003
<i>Geum glaciale</i>			64.75845306	-165.5285334	1705	alpine slope, dwarf shrub-	2006-009
<i>Geum rossii</i>			64.75845306	-165.5285334	1705	alpine slope, dwarf shrub-	2006-010
<i>He dysarum mackenzii</i>			64.74621573	-165.6398352	614	exposed gravelly slope	2006-032
<i>Hippuris vulgaris</i>			64.79644429	-165.5497313	513	small, shallow ponds next to river	2006-149
<i>Lesquerella arctica</i>			64.79392611	-165.40969	871	sparsely vegetated carbonate ridge	2006-095
<i>Luzula multiflora</i>			64.79644429	-165.5497313	513	small, shallow ponds next to river	2006-150
<i>Luzula tundrae</i>			64.77599513	-165.5254081	1102	sideslope, mesic dwarf	2006-005
<i>Luzula tundrae</i>			64.80891212	-165.6118571	1455	broad mountain ridge, fellfield	2006-142
<i>Mertensia eastwoodae</i>			64.80576203	-165.5571998	999	sideslope draw, low shrub-forb	2006-145
<i>Minuartia arctica</i>			64.77599513	-165.5254081	1102	sideslope, mesic dwarf	2006-004
<i>Minuartia biflora</i>	G5	S2	64.78170991	-165.5008291	1219	dry to moist dwarf shrub	2006-056
<i>Minuartia elegans</i>			64.74570989	-165.6410986	667	exposed gravelly knob	2006-044
<i>Minuartia macrocarpa</i>			64.74570989	-165.6410986	667	exposed gravelly knob	2006-048
<i>Oxytropis borealis</i>			64.82016491	-165.5071844	1010	dry open dwarf shrub graminoid	2006-105
<i>Oxytropis borealis</i>			64.81162936	-165.5742983	1428	mountain ridge, fellfield, rock	2006-133
<i>Oxytropis bryophila</i>			64.75845306	-165.5285334	1705	alpine slope, dwarf shrub-	2006-013
<i>Oxytropis gorodkovii</i>			64.74570989	-165.6410986	667	exposed gravelly knob	2006-049
<i>Oxytropis gorodkovii</i>			64.83320137	-165.4594924	1615	rubble slope and outcrop with	2006-122
<i>Oxytropis mertensiana</i>			64.77599513	-165.5254081	1102	sideslope, mesic dwarf	2006-002
<i>Papaver walpolei</i>	G3	S3	64.74621573	-165.6398352	614	exposed gravelly slope	2006-035
<i>Papaver walpolei</i>	G3	S3	64.79392611	-165.40969	871	sparsely vegetated carbonate ridge	2006-102
<i>Parnassia kotzebuei</i>			64.77029258	-165.4541601	586	cobbly stream bed, willow-forb	2006-078
<i>Parrya nudicaulis</i>			64.77432394	-165.5273099	1126	sideslope, base of solifluction	2006-008
<i>Parrya nudicaulis</i>			64.78170991	-165.5008291	1219	mossy snowbed with rocky	2006-053
<i>Pedicularis labradorica</i>			64.79323553	-165.4526014	579	ericaceous dwarf shrub tundra	2006-093
<i>Pedicularis parviflora</i> ssp.			64.7680977	-165.4662076	726	small creek drainage, graminoid-	2006-079
<i>Phlox alaskensis</i>			64.74570989	-165.6410986	667	exposed gravelly knob	2006-038
<i>Poa arctica</i>			64.7969	-165.5141	1615	moist bank along ATV trail	2006-124
<i>Poa glauca</i>			64.74570989	-165.6410986	667	exposed gravelly knob	2006-040
<i>Poa glauca</i>			64.82016491	-165.5071844	1010	dry open dwarf shrub graminoid	2006-114
<i>Poa paucispicula</i>			64.76757634	-165.461037	660	steep schist/shale outcrop	2006-084
<i>Podistera macounii</i>			64.75253753	-165.5551049	1521	exposed fellfield ridge	2006-031
<i>Podistera macounii</i>			64.75863143	-165.5209979	1504	moist, to seasonally wet	2006-062
<i>Podistera macounii</i>			64.75284959	-165.5339804	1756	moist overhangs and ledges of	2006-069
<i>Potentilla biflora</i>			64.74621573	-165.6398352	614	exposed gravelly slope	2006-036
<i>Potentilla elegans</i>			64.83336104	-165.4784545	1926	dry sparsely vegetated talus with	2006-115
<i>Potentilla hookeriana</i>			64.82016491	-165.5071844	1010	dry open dwarf shrub graminoid	2006-110
<i>Potentilla hyparctica</i>			64.75845306	-165.5285334	1705	alpine slope, dwarf shrub-	2006-016
<i>Potentilla uniflora</i>			64.75845306	-165.5285334	1705	alpine slope, dwarf shrub-	2006-017
<i>Potentilla uniflora</i>			64.75284959	-165.5339804	1756	moist overhangs and ledges of	2006-067
<i>Primula arvensis</i>	G3 G4	S3S4	64.77029258	-165.4541601	586	cobbly stream bed, willow-forb	2006-076
<i>Primula arvensis</i>	G3 G4	S3S4	64.77029258	-165.4541601	586	stream margin, wet meadows	2006-151
<i>Primula eximia</i>			64.78170991	-165.5008291	1219	mossy snow-melt stream in rocky	2006-055
<i>Primula eximia</i>			64.76582344	-165.508028	1733	late melting snowbed with moist	2006-057
<i>Ranunculus aurocomis</i>	G5	S2	64.80576203	-165.5571998	999	sideslope draw, low shrub-forb	2006-144
<i>Ranunculus eschscholtzii</i>			64.81393958	-165.5794562	1566	mountain ridge, wet graminoid-	2006-139
<i>Ranunculus nivalis</i>			64.78170991	-165.5008291	1219	mossy snow-melt stream in rocky	2006-054
<i>Ranunculus peatitidus</i>			64.75751328	-165.5245937	1571	moist dryas-empetrum heath at	2006-063
<i>Ranunculus pygmaeus</i>			64.76757634	-165.461037	660	steep schist/shale outcrop	2006-087
<i>Rhododendron camtschaticum</i>			64.80794258	-165.5384632	989	fellfield	2006-128
<i>Rumex lapponicus</i>			64.80576203	-165.5571998	999	sideslope draw, low shrub-forb	2006-146
<i>Salix hastata</i>			64.80576203	-165.5571998	999	sideslope draw, low shrub-forb	2006-147
<i>Salix myrtilifolia</i>			64.79323553	-165.4526014	579	moist to wet hummocky low	2006-091

Appendix I, continued

Name	Global_Rank	State_Rank	Latitude	Longitude	Elev (ft)	Habitat	Number
<i>Salix rotundifolia</i>			64.79392611	-165.40969	871	sparsely vegetated carbonate ridge	2006-101
<i>Saussurea viscida</i>			64.81393958	-165.5794562	1566	mountain ridge, wet graminoid-	2006-137
<i>Saxifraga calycina</i>			64.75284959	-165.5339804	1756	moist overhangs and ledges of	2006-070
<i>Saxifraga cernua</i>			64.75802047	-165.5318056	1786	alpine summit outcrop in dryas-	2006-023
<i>Saxifraga eschscholtzii</i>			64.75845306	-165.5285334	1705	alpine slope, dwarf shrub-	2006-014
<i>Saxifraga eschscholtzii</i>			64.75284959	-165.5339804	1756	moist overhangs and ledges of	2006-065
<i>Saxifraga flagellaris</i>			64.80576203	-165.5571998	999	sideslope draw, low shrub-forb	2006-148
<i>Saxifraga hieracifolia</i>			64.77599513	-165.5254081	1102	sideslope, mesic dwarf	2006-001
<i>Saxifraga nivalis</i>			64.75845306	-165.5285334	1705	alpine slope, dwarf shrub-	2006-015
<i>Saxifraga nivalis</i>			64.76757634	-165.461037	660	steep schist/shale outcrop	2006-088
<i>Saxifraga oppositifolia</i>			64.75802047	-165.5318056	1786	alpine summit outcrop in dryas-	2006-026
<i>Saxifraga rivularis</i>			64.76757634	-165.461037	660	steep schist/shale outcrop	2006-086
<i>Selaginella sibirica</i>			64.75284959	-165.5339804	1756	moist overhangs and ledges of	2006-066
<i>Senecio atropurpurea</i>			64.75751328	-165.5245937	1571	moist dryas-empetrum heath at	2006-064
<i>Smelowskia calycina</i> var.			64.74570989	-165.6410986	667	exposed gravelly knob	2006-039A
<i>Smelowskia calycina</i> var. <i>media</i>	G3G2Q	S2S3	64.83320137	-165.4594924	1615	unstable talus barrens and rubble	2006-119
<i>Smelowskia calycina</i> var. <i>media</i>	G3G2Q	S2S3	64.81162936	-165.5742983	1428	mountain ridge, fellfield, rock	2006-135
<i>Solidago multiradiata</i>			64.7680977	-165.4662076	726	small creek drainage, graminoid-	2006-081
<i>Stellaria dicranoides</i>	G3	S3	64.79392611	-165.40969	871	sparsely vegetated carbonate ridge	2006-103
<i>Stellaria dicranoides</i>	G3	S3	64.82016491	-165.5071844	1010	dry open dwarf shrub graminoid	2006-112
<i>Stellaria monantha</i>			64.80891212	-165.6118571	1455	broad mountain ridge, fellfield	2006-140
<i>Taraxacum alaskanum</i>			64.75863143	-165.5209979	1504	moist, to seasonally wet,	2006-059
<i>Taraxacum alaskanum</i>			64.75284959	-165.5339804	1756	moist dwarf shrub graminoid	2006-073
<i>Taraxacum alaskanum</i>			64.83320137	-165.4594924	1615	dry screes and outcrops with	2006-116
<i>Thalictrum alpinum</i>			64.81393958	-165.5794562	1566	mountain ridge, wet graminoid-	2006-138
<i>Viola biflora</i>			64.80794258	-165.5384632	989	fellfield, ground squirrel	2006-125
<i>Viola epipsala</i>			64.77029238	-165.4541601	586	cobbly stream bed, willow-forb	2006-077
<i>Woodsia glabella</i>			64.74570989	-165.6410986	667	exposed gravelly knob	2006-050
<i>Woodsia glabella</i>			64.79392611	-165.40969	871	sparsely vegetated carbonate ridge	2006-096

Appendix II

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.