

*ARNICA LESSINGII SSP. NORBERGII*  
*IN THE PORTAGE AREA:*  
*A SENSITIVE SPECIES SURVEY*

A Report by

Michael Duffy

Alaska Natural Heritage Program

ENVIRONMENT AND NATURAL RESOURCES INSTITUTE

UNIVERSITY OF ALASKA ANCHORAGE

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## INTRODUCTION

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The Alaska Department of Transportation and Public Facilities (ADOT&PF) has proposed upgrading access to the city of Whittier by constructing rail improvements or a road that would cross Chugach National Forest lands. HDR Engineering, on ADOT&PF's behalf, is assisting the U.S. Forest Service (USFS) in their preparation of a biological evaluation for land in the Portage area that could potentially be affected by project alternatives under consideration. During a survey of the road alignment in August 1994, individual plants closely matching the description of *Arnica lessingii* Greene ssp. *norbergii* Maguire & Hulten were found growing in an area that would receive direct impact from the project. This taxon is one of 22 in Alaska that were designated as sensitive by the USFS in January, 1994. The Alaska Natural Heritage Program (AKNHP) ranks it as an extremely rare endemic, with only five known occurrences, all in Alaska (see Appendix). *Papaver alboroseum* Hulten, another sensitive species found during the road alignment survey, was not to be addressed in this survey.

AKNHP is a part of the University of Alaska's Environment and Natural Resources Institute. Its Biological and Conservation Database (BCD) is a primary resource for tracking rare plants and animals throughout the state. After the initial discovery of the rare arnica in Bear Valley, AKNHP was contracted by HDR Engineering to perform a limited field survey to determine the general abundance and distribution of *Arnica lessingii* ssp. *norbergii* in the Portage Valley area.

The exact nature of this arnica's taxonomy is somewhat unclear. *Arnica lessingii* ssp. *norbergii* was briefly described by Maguire and Hulten in 1942 (Maguire, 1942). In their description, the main features used to distinguish it from ssp. *lessingii* are its greater height, the 5-6 pairs of cauline leaves and sparse pubescence. Hulten's key to the arnicas (Hulten 1968) used 4-6 pairs of cauline leaves as a distinguishing characteristic. Although the authors expressed some uncertainty of the rank of the taxon-whether it should be considered a subspecies or variety-the form was considered distinct. Other authors (Welsh, 1974; Kartesz, 1989) do not separate it from typical *Arnica lessingii*. The status of this taxon has yet to be fully resolved. Its AKNHP ranking of G5T1Q S2 reflects this uncertainty, considering the species to be globally secure (G5) and considering subspecies *norbergii* to be a rare and somewhat questionable taxon (T1Q), endemic to Alaska and vulnerable in the state (S2).

The purpose of the field survey described in this report was to locate, describe and document occurrences of plants that fit the description of *Arnica lessingii* ssp. *norbergii* in the Portage and Bear Valleys of Chugach National Forest.

## *SURVEY METHODOLOGY*

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After reviewing the literature about *Arnica lessingii* ssp. *norbergii*, we at AKNHP examined the plants collected from Bear Valley during August and discussed the habitat in which they were found. Using aerial photographs, we identified other likely occurrences of this habitat and planned four days of field reconnaissance.

The Bear Valley collection site was visited first to familiarize ourselves with the area. As other areas of suitable habitat were found, we walked through those areas and recorded the number of arnicas observed. The plants' characteristics were described and we estimated the percentage that fit the characteristics of ssp. *norbergii*. Information on the specific ecology of the population, including community type, associated species and soil moisture was recorded. Phenology of the plants, directions to each site and evidence of disturbance or browsing were also noted. When the number of plants in a population allowed, specimens were collected. Photographs were taken of some populations and individual plants.

*Arnica lessingii* ssp. *norbergii* is a rhizomatous plant, often with several stems (ramets) arising from a single rhizome. Population estimates reflect the number of distinct ramets observed. Small groups of ramets could be individually counted; for larger groups we made visual estimates of the number of ramets.

The large number of plant communities in Portage Valley precluded the preparation of a detailed list of plant species for that area. A list of plants observed for Bear Valley was recorded, and is on file with AKNHP in Anchorage. Descriptions of arnica sites included dominant species. Other rare plants and range extensions observed during the course of this survey were also noted.

## RESULTS OF THE PORTAGE AREA SURVEYS

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Two days of field surveys were conducted in Bear Valley, and two in Portage Valley. Populations resembling *Arnica lessingii* ssp. *norbergii* were found in each valley, as well as populations of *Arnica lessingii* ssp. *lessingii* and large numbers of intermediates showing characteristics of both subspecies. No other species of arnica were located in the study area except for *Arnica cf chamissonis* that was planted in the garden outside Portage Lodge. Photos, maps and a list of all previous Element Occurrences from the BCD are contained in the Appendices. The survey routes are shown on Map 1, and detailed maps of the occurrences of arnicas are shown on Maps 2 and 3.

The survey results are summarized in Table 1. A site is defined by the presence of a distinct group of plants, separated from other groups. The total number of arnicas in a group was estimated and a rough percentage of ramets distinctly matching ssp. *norbergii* estimated. The presence of at least 4 pairs of stem leaves and the height of the stems (usually more than 40 cm) were used to determine plants that fit ssp. *norbergii*. Percentages reflect the amount of that population that met the criteria for ssp. *norbergii*, including non-flowering stems that may have been shorter but appeared to be arising from the same rhizome as the tall flowering stalks. Plants referred to as ssp. *lessingii* were consistently shorter, with fewer leaves which were crowded at the base, remote from the flower. For many of the plants observed, subspecific distinctions were unclear and they were referred to as tall or short intermediates. Lacking a regional protocol, the format used for the detailed population descriptions is based on standard forms used by other National Forests in the Pacific Northwest for rare plant inventory.

Aside from the arnica, the only other sensitive species encountered was *Papaver alboroseum*, which had already been documented by HDR and USFS staff. We did not observe any poppies that had not already been counted, and no other rare plants were seen.

Note that sites 1 and 10a are the results of the August field work, and were included to allow for a more complete representation of the extent of *Arnica lessingii* ssp. *norbergii* in the study area.

**Table 1: *Arnica lessingii* ssp. *norbergii* observed in the Portage Area.**

8 September 1994: Bear Valley

site	# plants found	% ssp. <i>norbergii</i>
1	100	80%
2	150	80%



**Table 1: *Arnica lessingii* ssp. *norbergii* observed in the Portage Area.**

8 September 1994: Bear Valley (continued)

<b>site</b>	<b># plants found</b>	<b>% ssp. <i>norbergii</i></b>
3	145	80%
4	10	100%
5	770	0%
6	1150	0%
7	2	0%
8	7	0%

10 September 1994: Bear Valley

<b>site</b>	<b># plants found</b>	<b>% ssp. <i>norbergii</i></b>
9	11	0%
10	300	75%
10a	65	80%
11	100	0%
12	90	25%
13	6	0%
14	70	25%
15	3000	0%
16	10	0%
17	120	0%

12 September 1994: Portage Valley

<b>site</b>	<b>number found</b>	<b>% ssp. <i>norbergii</i></b>
18	4035	50%
19	140	0
20	500	0

13 September 1994: Portage Valley

<b>site</b>	<b>number found</b>	<b>% ssp. <i>norbergii</i></b>
21	14,775	15%

## DETAILED SITE DESCRIPTIONS

**Survey Area:** Bear Valley.

**Site number:** 1 (surveyed previous to this contract).

**Date:** 10 August 1994.

**Observers:** Connie Hubbard (USFS) and Anne Leggett (HDR).

**Location:** Seward D-5 quad T8N R4E Section 18 NE4NW4.

**Elevation:** 100 feet (30 meters).

**Directions:** N of small pond area, W of the mouth of Placer Creek.

**Population size:** 100.

**Percentage of ssp. *norbergii*:** 80%, the rest tall intermediates.

**Phenology:** plants in flower.

**Habitat:** growing at margin of willow/alder scrub, in *Calamagrostis canadensis* and *Carex* sp.

**slope:** flat.

**soil, moisture:** moist soil.

**Specimens collected:** Leggett 94081001, 94081901.

**Photos:** 13,14.

**Survey Area:** Bear Valley.

**Site number:** 2.

**Date:** 8 September 1994.

**Observers:** Mike Duffy (AKNHP), Anne Leggett (HDR).

**Location:** Seward D-5 quad T8N R4E Section 18 NE4NW4.

**Elevation:** 100 feet (30 meters).

**Directions:** around small pond, W of mouth of Placer Creek.

**Population size:** 150.

**Percentage of ssp. *norbergii*:** 80%, the rest tall intermediates.

**Phenology:** About 10% with aging flowers, most with seed heads. About 20% vegetative shoots only. Several plants had been grazed.

**Habitat:** Ecotone of closed willow scrub and wet sedge meadow. *Carex kellogii*, *Carex macrochaeta* and *Deschampsia caespitosa* dominated the graminoid meadow; *Salix barclayi* dominated the scrub, with *Alnus sinuata*. This preference for shrub margins is seen at almost all sites with ssp. *norbergii*.

**slope:** flat.

**soil, moisture:** moist to fairly wet soil.

**Specimens collected:** MD94-P14, MD94-P15.

**Survey Area:** Bear Valley.

**Site number:** 3.

**Date:** 8 September 1994.

**Observers:** Mike Duffy, Anne Leggett.  
**Location:** Seward D-5 quad T8N R4E Section 7 SE4SW4.  
**Elevation:** 120 feet (35 meters).  
**Directions:** wet meadows adjacent to Placer Creek, 10-50 meters NE of railroad bridge.  
**Population size:** 75, in groups under willows.  
**Percentage of *ssp. norbergii*:** 80%, the rest tall intermediates.  
**Phenology:** 30% with seed heads, the rest vegetative shoots.  
**Habitat:** wet open low willow meadow, with sphagnum bog meadows. Plants were growing on the margins of willow hummocks and borders.  
**slope:** flat.  
**soil, moisture:** moist to wet soil, slightly boggy.  
**Specimens collected:** MD94-P33.

**Survey Area:** Bear Valley.  
**Site number:** 4.  
**Date:** 8 September 1994.  
**Observers:** Mike Duffy, Anne Leggett.  
**Location:** Seward D-5 quad T8N R4E Section 7 SE4SW4.  
**Elevation:** 120 feet (35 meters).  
**Directions:** 15 m N of site 3.  
**Population size:** 10.  
**Percentage of *ssp. norbergii*:** 100%.  
**Phenology:** all plants past flowering, half of them grazed. Lots of microtine activity in the area.  
**Habitat:** same as site 3.  
**slope:** flat.  
**soil, moisture:** moist soil.

**Survey Area:** Bear Valley.  
**Site number:** 5.  
**Date:** 8 September 1994.  
**Observers:** Mike Duffy, Anne Leggett.  
**Location:** Seward D-5 quad T8N R4E Section 7 SE4SW4.  
**Elevation:** 130 feet (40 meters).  
**Directions:** 75 meters N of railroad, 15 meters east of small pond.  
**Population size:** 770.  
**Percentage of *ssp. norbergii*:** almost all plants were small intermediates.  
**Phenology:** 40% with seed heads, most vegetative shoots, heavily grazed.  
**Habitat:** open low willow scrub, sparse graminoid-forb understory.  
**slope:** slight.  
**aspect:** west.

**soil, moisture:** moist to mesic gravel and thinly developed soil with moss layer.  
**Photos:** 1, 2, 3.

**Survey Area:** Bear Valley.

**Site number:** 6.

**Date:** 8 September 1994.

**Observers:** Mike Duffy, Anne Leggett.

**Location:** Seward D-5 quad T8N R4E Section 7 SE4SW4.

**Elevation:** 100 feet (30 meters).

**Directions:** N and E of site 5; under willows, just south of southernmost fork of Placer Creek.

**Population size:** 1150.

**Percentage of *ssp. norbergii*:** same as site 5.

**Phenology:** same as site 5.

**Habitat:** same as site 5, somewhat drier.

**slope:** flat.

**soil, moisture:** mesic gravelly soil.

**Survey Area:** Bear Valley.

**Site number:** 7.

**Date:** 8 September 1994.

**Observers:** Mike Duffy, Anne Leggett.

**Location:** Seward D-5 quad T8N R4E Section 7 SW4NE4.

**Elevation:** 130 feet (40 meters).

**Directions:** 50 meters N of site 6, N of southernmost fork of Placer Creek.

**Population size:** 2.

**Percentage of *ssp. norbergii*:** both small plants.

**Phenology:** past flowering.

**Habitat:** opening in tall alder scrub.

**slope:** flat.

**soil, moisture:** moist mud.

**Survey Area:** Bear Valley.

**Site number:** 8.

**Date:** 8 September 1994.

**Observers:** Mike Duffy, Anne Leggett.

**Location:** Seward D-5 quad T8N R4E Section 7 SE4SW4.

**Elevation:** 130 feet (40 meters).

**Directions:** W bank of Placer Creek, 100 meters N of railroad.

**Population size:** 7.

**Percentage of *ssp. norbergii*:** all small plants.

**Phenology:** past flowering.  
**Habitat:** open alder scrub/ tall forb graminoid meadow.  
**slope:** slight incline.

**aspect:** east.  
**soil, moisture:** mesic soil, along seep.

**Survey Area:** Bear Valley.  
**Site number:** 9.  
**Date:** 10 September 1994.  
**Observers:** Mike Duffy, Anne Leggett.  
**Location:** Seward D-5 quad T8N R4E Section 18 NE4NW4.  
**Elevation:** 100 feet (30 meters).  
**Directions:** Portage Lake beach, just E of mouth of Placer Creek.  
**Population size:** 11.  
**Percentage of ssp. *norbergii*:** all small to medium plants.  
**Phenology:** late flowering.  
**Habitat:** sandy beach and graminoid meadow/scrub margin.  
**slope:** flat.  
**soil, moisture:** mesic sand.

**Survey Area:** Bear Valley.  
**Site number:** 10.  
**Date:** 10 September 1994.  
**Observers:** Mike Duffy, Anne Leggett.  
**Location:** Seward D-5 quad T8N R4E Section 18 NE4NW4.  
**Elevation:** 100 feet (30 meters).  
**Directions:** E side of Placer Creek, 250 meters south of bridge.  
**Population size:** 300.  
**Percentage of ssp. *norbergii*:** 75%.  
**Phenology:** past flowering.  
**Habitat:** graminoid meadow/scrub margin.  
**slope:** flat.  
**soil, moisture:** moist to mesic soil.

**Survey Area:** Bear Valley.  
**Site number:** 10a (surveyed previous to this contract).  
**Date:** 19 August 1994.  
**Observers:** Connie Hubbard, Anne Leggett.  
**Location:** Seward D-5 quad T8N R4E Section 18 NE4NW4.

**Elevation:** 100 feet (30 meters).  
**Directions:** just N of old road embankment and small pond, 100 meters south of bridge.  
**Population size:** 65.  
**Percentage of *ssp. norbergii*:** 80%.  
**Phenology:** flowering.  
**Habitat:** graminoid meadow/scrub margin.  
    **slope:** flat.  
    **soil, moisture:** moist to mesic silt.  
**Specimens collected:** Leggett 94081903.

**Survey Area:** Bear Valley.  
**Site number:** 11.  
**Date:** 10 September 1994.  
**Observers:** Mike Duffy, Anne Leggett.  
**Location:** Seward D-5 quad T8N R4E Section 18 NE4NW4.  
**Elevation:** 110 feet (35 meters).  
**Directions:** small pond 30 meters E of creek, 120 meters S of bridge.  
**Population size:** 100.  
**Percentage of *ssp. norbergii*:** small plants, *ssp. lessingii*.  
**Phenology:** past flowering.  
**Habitat:** open alder scrub/ tall forb graminoid meadow.  
    **slope:** slight incline.  
    **aspect:** east.  
    **soil, moisture:** wet to mesic soil.  
**Specimens collected:** Leggett 94081904.

**Survey Area:** Bear Valley.  
**Site number:** 12.  
**Date:** 10 September 1994.  
**Observers:** Mike Duffy, Anne Leggett.  
**Location:** Seward D-5 quad T8N R4E Section 18 NW4NE4.  
**Elevation:** 130 feet (40 meters).  
**Directions:** follow railroad to middle of valley, open scrub S of tracks.  
**Population size:** 90.  
**Percentage of *ssp. norbergii*:** 25%, most plants intermediate size.  
**Phenology:** past flowering.  
**Habitat:** open willow scrub.  
    **slope:** flat.  
    **soil, moisture:** dry to mesic gravel and thin soil.

**Survey Area:** Bear Valley.  
**Site number:** 13.  
**Date:** 10 September 1994.  
**Observers:** Mike Duffy, Anne Leggett.  
**Location:** Seward D-5 quad T8N R4E Section 18 NE4NE4.  
**Elevation:** 100 feet (30 meters).  
**Directions:** E end of valley, 150 meters S of tunnel, on alluvial fan.  
**Population size:** 6.  
**Percentage of ssp. *norbergii*:** intermediates.  
**Phenology:** all vegetative.  
**Habitat:** understory of 1.5 meter tall willow scrub, with *Calamagrostis canadensis*.  
    **slope:** flat.  
    **soil, moisture:** moist soil.

**Survey Area:** Bear Valley.  
**Site number:** 14.  
**Date:** 10 September 1994.  
**Observers:** Mike Duffy, Anne Leggett.  
**Location:** Seward D-5 quad T8N R4E Section 7 SE4SE4.  
**Elevation:** 130 feet (35 meters).  
**Directions:** beaver ponds 200 meters N of railroad.  
**Population size:** 70.  
**Percentage of ssp. *norbergii*:** 25%; the rest tall intermediates.  
**Phenology:** past flowering.  
**Habitat:** open alder scrub.  
    **slope:** flat.  
    **soil, moisture:** moist to wet soil.

**Survey Area:** Bear Valley.  
**Site number:** 15.  
**Date:** 10 September 1994.  
**Observers:** Mike Duffy, Anne Leggett.  
**Location:** Seward D-5 quad T8N R4E Section 7 NW4SE4.  
**Elevation:** 100 feet (30 meters).  
**Directions:** large bog 250 meters N of railroad, center of valley.  
**Population size:** 3000.  
**Percentage of ssp. *norbergii*:** almost all small intermediates.  
**Phenology:** past flowering.  
**Habitat:** wet bog meadow-small hummocks above wet moss.  
    **slope:** slight.

**aspect:** north.  
**soil, moisture:** wet soil.  
**Specimens collected:** MD94-P32.  
**Photos:** 4, 5, 6, 7.

**Survey Area:** Bear Valley.  
**Site number:** 16.  
**Date:** 10 September 1994.  
**Observers:** Mike Duffy, Anne Leggett.  
**Location:** Seward D-5 quad T8N R4E Section 7 SW4SE4.  
**Elevation:** 130 feet (45 meters).  
**Directions:** 150 meters N of railroad, 150 meters E of creek.  
**Population size:** 10.  
**Percentage of ssp. *norbergii*:** all small plants.  
**Phenology:** past flowering.  
**Habitat:** open alder scrub/black cottonwood woodland.  
**slope:** flat.  
**soil, moisture:** mesic gravelly soil.

**Survey Area:** Bear Valley.  
**Site number:** 17.  
**Date:** 10 September 1994.  
**Observers:** Mike Duffy, Anne Leggett.  
**Location:** Seward D-5 quad T8N R4E Section 7 SE4SW4.  
**Elevation:** 130 feet (45 meters).  
**Directions:** 100 meters N of railroad, 100 meters E of creek.  
**Population size:** 3120.  
**Percentage of ssp. *norbergii*:** all small plants.  
**Phenology:** similar to site 16.  
**Habitat:** similar to site 16.  
**slope:** flat.  
**soil, moisture:** mesic gravelly soil.

**Survey Area:** Portage Valley.  
**Site number:** 18.  
**Date:** 12 September 1994.  
**Observers:** Bill Queitzsch (USFS), Mike Duffy.  
**Location:** Seward D-5 quad T8N R3E Section 14 SW4NE4.  
**Elevation:** 150 feet (45 meters).



**Directions:** Follow Williwaw Trail from campground to footbridge; continue past bridge on N side of creek/beaver pond and follow small clearing E. Plants found on N side of clearing until it closes up just short of small lake.

**Population size:** 4035, in dense clumps.

**Percentage of ssp. *norbergii*:** 50% were distinctly ssp. *norbergii*, with the rest being tall intermediates. These plants were the tallest encountered on the survey.

**Phenology:** 20% flowering stalks, mostly in fruit, a few with aging flowers.

**Habitat:** the clearing was like an old streambed, 3 meters wide at the widest point and gradually narrowing. The plants were growing in a mixture of *Carex macrochaeta* and *Deschampsia caespitosa*, at the edge of 1 meter tall willow. The surrounding scrub was 4 meter alder, with a mixture of black cottonwood.

**slope:** flat.

**aspect:** although the site was flat, the plants were almost entirely situated on the north side of the clearing, receiving as much exposure to the sun as was available.

**soil, moisture:** moist soil.

**Specimens collected:** MD94-P35, MD94-P36, MD94-P37.

**Photos:** 8, 9, 10, 11.

**Survey Area:** Portage Valley.

**Site number:** 19.

**Date:** 12 September 1994.

**Observers:** Bill Queitzsch, Mike Duffy.

**Location:** Seward D-5 quad T8N R3E Section 14 SE4SE4.

**Elevation:** 150 feet (45 meters).

**Directions:** from site 18, proceed E to end of lake, then S through cottonwoods to beaver pond. Plants were found at the narrow E end.

**Population size:** 140, scattered.

**Percentage of ssp. *norbergii*:** all small to medium height intermediates.

**Phenology:** all past flowering.

**Habitat:** open .5 meter tall willow.

**slope:** flat.

**soil, moisture:** mesic soil.

**Survey Area:** Portage Valley.

**Site number:** 20.

**Date:** 12 September 1994.

**Observers:** Bill Queitzsch, Mike Duffy.

**Location:** Seward D-5 quad T8N R3E Section 14 NW4SE4.

**Elevation:** 150 feet (45 meters).

**Directions:** from site 18, proceed E to lake, follow shoreline south. Plants were found

in scrub at SW corner of lake.

**Population size:** 500, widely scattered.

**Percentage of ssp. *norbergii*:** all medium tall intermediates.

**Phenology:** all past flowering, with seed heads heavily grazed.

**Habitat:** succeeding beaver pond- 1 meter tall open *Salix sitchensis* with *Carex* sp. and *Deschampsia caespitosa*.

**slope:** flat.

**soil, moisture:** mesic soil.

**Survey Area:** Portage Valley.

**Site number:** 21.

**Date:** 13 September 1994.

**Observers:** Connie Hubbard, Mike Duffy, Anne Leggett.

**Location:** Seward D-5 quad T8N R3E Section 14 SE4NE4.

**Elevation:** 150 feet (45 meters).

**Directions:** about 50 meters E of Williwaw campground, 75 meters S of road.

**Population size:** 14,775, in dense clumps under vegetation and also widely scattered in open low willow scrub.

**Percentage of ssp. *norbergii*:** about 15% fit the description of ssp. *norbergii*, 25% fit ssp. *lessingii*, and the largest percentage representing every intermediate type possible.

**Phenology:** all plants past flowering, with approximately half having flower stalks and the rest vegetative growth only.

**Habitat:** open low willow scrub, and around the edges of a dried up pond in taller scrub and underneath spruce trees.

**slope:** flat.

**aspect:** in the open area of the dry pond, the plants were grouped as in site 18- almost entirely on the north side of the clearing. Plants growing in the willow scrub of the west end of the polygon did not show such grouping.

**soil, moisture:** mesic to fairly moist gravelly soil.

**Specimens collected:** MD94-P41, MD94-P42.

**Photos:** 12, 13.

## SUMMARY

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Although late in the season, the survey for *Arnica lessingii* ssp. *norbergii* did locate several populations that fit the description of the taxon. Most populations, however, were of an intermediate form and some matched typical ssp. *lessingii*. The scope of this survey does not allow for a taxonomic review, but some generalizations can be made from the populations observed.

The largest plants fit Maguire and Hulten's description very well. They are tall plants (sometimes over 6 dm long) with 5-6 pairs of stem leaves, well separated by long internodes. The habitat in which they were growing was also markedly different from the more usual alpine and subalpine communities where *Arnica lessingii* is typically found. Their habitat seems to be fairly distinct—the ecotone of a closed willow scrub or willow/alder scrub and graminoid meadow, with *Deschampsia caespitosa* and *Carex macrochaeta* being distinctive (though not exclusive) components. *Calamagrostis canadensis* was also associated with the arnicas, but areas with very dense and uniform *Calamagrostis* often did not have any plants. Tall plants were usually growing under or next to willow bushes. Small plants, closely matching typical ssp. *lessingii* were often, though not always, growing in open areas. These sites were often more boggy, having a greater cover of mosses but without the tall graminoids associated with ssp. *norbergii*.

The populations with the greatest percentage of ssp. *norbergii* observed were restricted to the lower portion of Placer Creek in Bear Valley, on both sides of the creek (sites 1-4, 10 and 10a) and the beaver pond margin near Williwaw trail in Portage Valley (site 18). Other sites contained plants that were intermediate between the two subspecies, some of the plants being quite tall with three to four pairs of widely spaced leaves. The population at site 21 exhibited a complete range of every possible combination of height and leaf number, with an approximate 25-60-15 ratio of ssp. *lessingii* types, intergrades and ssp. *norbergii* types.

The survey reached most of the areas that could be considered suitable arnica habitat by examining aerial photos. Areas that seemed suitable did not always contain arnicas, and sometimes arnicas were found in unlikely habitats (as in site 7). Generally, the sites in which arnicas were found were in Bear Valley and the easternmost portion of Portage Valley. None of the areas surveyed in western Portage Valley contained any arnicas. It is possible that there may be additional populations of *Arnica lessingii* ssp. *norbergii*, especially where the area of the habitat is too small to be interpreted from aerial photographs, and north of Portage Creek, which we were not able to access.

Clearly, many questions remain about the taxonomic status of *Arnica lessingii* ssp. *norbergii*. Although much of the material is strikingly distinct from typical ssp. *lessingii* seen elsewhere, populations in the Portage area exhibited a wide range of morphological variation. This variation

could indicate either a single variable taxon or two distinct taxa with considerable introgression or hybridization. The apparent differences in habitat further add to the confusion. A systematic review is needed to clarify the taxonomy of this species complex. Seeds and pressed material were collected and could be used for morphological, cytological and molecular studies, as well as comparisons of growth and habit in controlled environments. These studies would, of course, require additional funding. The specimens collected were sent to the University of Alaska Fairbanks Museum Herbarium for review and will be sent to the USFS regional botanist for curation and distribution.

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*APPENDICES*

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**APPENDIX A: MAPS OF THE PORTAGE AREA SURVEYS**









**APPENDIX B: PHOTOS OF SELECTED SURVEY SITES AND SPECIMENS**

PHOTO 1 SITE 5  
Bear Valley, NE of  
bridge, plants in  
willow scrub margin.

PHOTO 2 SITE 5  
Bear Valley, NE of  
bridge, plants in  
willow scrub margin.

PHOTO 3 SITE 5  
Bear Valley, NE of  
bridge, plants in

willow scrub margin.

PHOTO 4 SITE 15  
Bear Valley, bog site  
mid valley N of rail  
road, polygon center.

PHOTO 5 SITE 15  
Bear Valley, bog site  
mid valley N of rail  
road, polygon center  
General habitat view,  
looking N.

PHOTO 6 SITE 15  
Bear Valley, bog site  
mid valley N of rail

road, polygon west side.

PHOTO 7 SITE 15

Bear Valley, bog site  
mid valley N of rail  
road, polygon west side.

PHOTO 8 SITE 18

Portage Valley, bridge  
of Williwaw trail, E  
end of beaver pond.

PHOTO 9 SITE 18

Portage Valley, bridge  
of Williwaw trail, E  
end of beaver pond.

Collected specimens.



PHOTO 10 SITE 18  
Portage Valley, Williwaw  
trail bridge beaver pond  
edge. General habitat  
view, looking W.

PHOTO 11 SITE 18  
Bear Valley, Williwaw  
trail bridge beaver pond  
edge. General habitat

view, looking E.

PHOTO 12 SITE 21  
Portage Valley, ponds  
east of Williwaw camp-  
ground.

PHOTO 13 SITE 1  
Bear Valley, E of  
mouth of Placer Creek.

PHOTO 14 SITE 1  
Bear Valley, E of  
mouth of Placer Creek.

Collected specimens.

**APPENDIX C: ELEMENT OCCURRENCES OF ARNICA LESSINGII SSP.  
NORBERGII**

**EO: 003**

**ARNICA LESSINGII SSP NORBERGII**

**GRANK:** G5T2Q  
**SRANK:** S2  
**SURVEYSITE:** MENDENHALL  
**QUADNAME:** JUNEAU B2  
**LAT:** 58 25 44N  
**LONG:** 134 31 44W  
**TOWN/RANGE:** 40S 66E  
**SECTION:** 4  
**MERIDIAN:** Copper River  
**DIRECTIONS:** Mendenhall  
**GENDESC:** Not available.  
**ELEVATION:** 212M  
**MANAME:** Tongass National Forest  
Chatham Area - Tongass National Forest  
Juneau Ranger District - Tongass National Forest  
**COMMENTS:** Occurrence from (HULTEN 1941-1950), in which the herbarium specimen,  
collected by Anderson (and housed in Stockholm), is enumerated.  
**SPECIMENS:** 1927 ANDERSON, J.P. 375. S

COLLECTION#: 5048  
SPECIMEN#: 5049  
**COLLECTOR:** ANDERSON, J.P.  
**DATE:** 1927  
**COLLECTION #:** 375  
**NUM.SHEETS:** 1  
**HERB.INST:** S  
**LIT.SOURCE:** HULTEN 1941-1950

**EO: 001**

**ARNICA LESSINGII SSP NORBERGII**

**GRANK:** G5T2Q  
**SRANK:** S2  
**SURVEYSITE:** ORCA  
**QUADNAME:** CORDOVA C5

**LAT:** 60 34 44N  
**LONG:** 145 42 58W  
**TOWN/RANGE:** 5S 3W  
**SECTION:** 11  
**MERIDIAN:** Copper River  
**DIRECTIONS:** Orca vicinity  
**GENDESC:** Damp meadow  
**ELEVATION:** 30.5M  
**MANAME:** Chugach National Forest  
Cordova Ranger District - Chugach National Forest  
**COMMENTS:** Occurrence from (HULTEN 1941-1950), in which three herbarium specimens, all collected by Norberg (two of which are housed in Stockholm), are enumerated. One herbarium specimen at WTU, accession no. 292825: isotype, I.L. Norberg, s.n., Aug. 14, 1937.  
**SPECIMENS:** 1937 NORBERG, I.L. SN. H.; S; WTU; WTU

COLLECTION#: 5045  
SPECIMEN#: 5045  
**COLLECTOR:** NORBERG, I.L.  
**DATE:** 08/1937  
**COLLECTION #:** SN  
**NUM.SHEETS:** 3  
**HERB.INST:** WTU  
**ACCESS NO:** 292825  
**TYPE:** ISOTYPE  
**LIT.SOURCE:** HULTEN 1941-1950

SPECIMEN#: 5046  
**COLLECTOR:** NORBERG, I.L.  
**DATE:** 08/1937  
**COLLECTION #:** SN  
**NUM.SHEETS:** 3  
**HERB.INST:** S

SPECIMEN#: 5052  
**COLLECTOR:** NORBERG, I.L.  
**DATE:** 08/1937  
**COLLECTION #:** SN  
**NUM.SHEETS:** 3  
**HERB.INST:** WTU  
**ACCESS NO:** 292825

SPECIMEN#: 5053

**COLLECTOR:** NORBERG, I.L.  
**DATE:** 08/1937  
**COLLECTION #:** SN  
**NUM.SHEETS:** 3  
**HERB.INST:** H:

**EO:** 002

ARNICA LESSINGII SSP NORBERGII

**GRANK:** G5T2Q  
**SRANK:** S2  
**SURVEYSITE:** JUNEAU  
**QUADNAME:** JUNEAU B2  
**LAT:** 58 18 43N  
**LONG:** 134 24 04W  
**TOWN/RANGE:** 41S 67E  
**SECTION:** 14  
**MERIDIAN:** Copper River  
**DIRECTIONS:** Juneau  
**GENDESC:** Not available  
**ELEVATION:** 305M  
**MANAME:** Tongass National Forest  
Chatham Area - Tongass National Forest  
Juneau Ranger District - Tongass National Forest

**COMMENTS:** Occurrence from (HULTEN 1941-1950), in which two herbarium specimens, collected by Anderson and by Hulten (housed in Stockholm), are enumerated.

**SPECIMENS:** 1940 ANDERSON, J.P.; HULTEN, E. 8144. ALA

COLLECTION#: 5047  
SPECIMEN#: 5047  
**COLLECTORS:** ANDERSON, J.P.  
HULTEN, E.  
**DATE:** 08/1940  
**COLLECTION #:** 8144  
**NUM.SHEETS:** 2  
**HERB.INST:** ALA  
**ACCESS NO:** 6401  
**LIT.SOURCE:** HULTEN 1941-1950

**EO:** 005

ARNICA LESSINGII SSP NORBERGII

**GRANK:** G5T2Q  
**SRANK:** S2  
**SURVEYSITE:** PORT SAN JUAN, EVANS ISLAND  
**QUADNAME:** SEWARD A3  
**LAT:** 60 03 08N  
**LONG:** 148 04 01W  
**TOWN/RANGE:** 1S 8E  
**SECTION:** 34  
**MERIDIAN:** Seward  
**DIRECTIONS:** Port San Juan, Evans Island, Prince William Sound.  
**GENDESC:** Not available.  
**ELEVATION:** 0M  
**MANAME:** Chugach National Forest  
Cordova Ranger District - Chugach National Forest  
**COMMENTS:** EO based on report of specimen in Hulten, 1941: W.J. Eyerdam 4116 (H),  
7022 (H), and 5883 (WTU), 7/15/48.  
**SPECIMENS:** 1948 EYERDAM, W.J. 4116. H.; H.; WTU

COLLECTION#: 5054  
SPECIMEN#: 5054  
**COLLECTOR:** EYERDAM, W.J.  
**DATE:** 07/1948  
**COLLECTION #:** 4116  
**NUM.SHEETS:** 3  
**HERB.INST:** WTU  
**ACCESS NO:**5883

SPECIMEN#: 5055  
**COLLECTOR:** EYERDAM, W.J.  
**DATE:** 07/1948  
**COLLECTION #:** 4116  
**NUM.SHEETS:** 3  
**HERB.INST:** H:  
**ACCESS NO:**4116

SPECIMEN#: 5056  
**COLLECTOR:** EYERDAM, W.J.  
**DATE:** 07/1948  
**COLLECTION #:** 4116  
**NUM.SHEETS:** 3  
**HERB.INST:** H:



**ACCESS NO:7022**

**EO: 004**

**ARNICA LESSINGII SSP NORBERGII**

**GRANK:** G5T2Q  
**SRANK:** S2  
**SURVEYSITE:** MT. ROBERTS  
**QUADNAME:** JUNEAU B2  
**LAT:** 58 17 25N  
**LONG:** 134 21 02W  
**TOWN/RANGE:** 41S 67E  
**SECTION:** 30  
**MERIDIAN:** Copper River  
**DIRECTIONS:**On rocky ledges on Gastineau Peak at about 3500 ft., Mt. Roberts (Trail?),  
Juneau  
**GENDESC:** On rocky ledges  
**ELEVATION:** 1070M  
**MANAME:** Tongass National Forest  
Chatham Area - Tongass National Forest  
Juneau Ranger District - Tongass National Forest  
**COMMENTS:**Occurrence based on ALA herbarium specimen: Maxcine Williams 1390;  
determined and annotated by V.L. Harms, 6/10/68.  
**SPECIMENS:** 1965 WILLIAMS, M. 1390. ALA

**COLLECTION#:** 5014  
**SPECIMEN#:** 5014  
**COLLECTOR:** WILLIAMS, M.  
**DATE:** 08/1965  
**COLLECTION #:** 1390  
**HERB.INST:** ALA  
**DET.BY:** HARMS, V.L.

**EO: 006**

**ARNICA LESSINGII SSP NORBERGII**

**GRANK:** G5T2Q  
**SRANK:** S2  
**SURVEYSITE:**PRINCE WILLIAM SOUND, UNAKWIK INLET (?)  
**QUADNAME:** ANCHORAGE A2  
**LAT:** 61 06 03N

**LONG:** 147 29 04W  
**TOWN/RANGE:** 12S 11E  
**SECTION:** 27  
**MERIDIAN:** Seward  
**DIRECTIONS:** Prince William Sound, Unakwik Inlet, Brilliant Glacier area. Survey site #R93-40.  
**GENDESC:** Gravelly tundra meadow.  
**ELEVATION:** 685M  
**MANAME:** Chugach National Forest  
Cordova Ranger District - Chugach National Forest  
**COMMENTS:** Specimen collected by Mike Duffy during 1993 USFS Region Ten/ AKNHP rare plant survey (collection No. 93-1108). Specimen on which occurrence is based is identified only as ARNICA LESSINGII by Carolyn Parker, of the UAF Herbarium, but is a tall plant that appears to approach SSP NORBERGII, it may represent a transition to SSP NORBERGII or merely an extremely tall individual.  
**SPECIMENS:** 1993 DUFFY, MIKE. 93-1108. ALA

COLLECTION#: 5397  
SPECIMEN#: 5444  
**COLLECTOR:** DUFFY, MIKE  
**DATE:** 08/1993  
**COLLECTION #:** 93-1108  
**HERB.INST:** ALA  
**DET.BY:** C. PARKER