

Plant Species Evaluation Form

Boecheera ultraalsa Windham & Al-Shehbaz

SNOW MOUNTAIN ROCKCRESS

Family: Brassicaceae
(CNPS 2018)

PLANTS Symbol: BOUL
(USDA 2018)

Calif. Endemic: Yes
(CNPS 2018)

Synonyms/Other Names: *Boecheera ultraalsa* was originally identified as *Arabis platysperma* Gray, which later became *Boecheera platysperma* (A. Gray) Al-Shehbaz (Al-Shehbaz 2003). *Boecheera ultraalsa* was segregated from *B. platysperma* as a new species in 2006 (Windham and Al-shehbaz 2006). There are no synonyms, but the spelling variant of “*ultra-alsa*” is listed by some sources (Windham and Al-Shehbaz 2012; Tropicos 2018).

Identification Issues: *Boecheera platysperma* and its segregate species, *B. ultraalsa* and *B. howellii*, are distinctive among *Boecheera* species in having wide (3-5 mm wide), erect siliques (Windham and Al-Shehbaz 2012). *Boecheera ultraalsa* is known only from its holotype specimen, which Windham and Al-Shehbaz (2006) considered distinct enough to segregate from *B. platysperma*. A visible distinction is that, although it shares with *B. platysperma* the distinctively wide, erect siliques, its siliques are flat with parallel edges, not undulate with constrictions between the seeds, as is characteristic of *B. platysperma*. Additional microfeatures separate *B. ultraalsa* from *B. platysperma*: *B. ultraalsa* has petioles without obvious cilia (*B. platysperma* has ciliate petioles, the cilia consisting of simple or spurred trichomes to 1 mm long), and basal leaves with long-stalked (0.1-0.2 mm), 3- to 6(7)-rayed trichomes 0.2-0.5 mm long (*B. platysperma* has basal leaves with short-stalked (rarely to 0.1 mm) 2- to 4(-5)-rayed trichomes 0.1-0.3 mm long (Windham and Al-shehbaz 2006).

Boecheera howellii, which shares a wide, erect silique with *B. platysperma* and *B. ultraalsa*, has in contrast, nearly glabrous foliage, and is primarily a Sierra Nevada species with a higher elevation range of 1,800-3,800 meters (Windham and Al-Shehbaz 2006, 2012).

Taxonomy:

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Species In Genus: 110+ species: temperate North America, Russian Far East. Etymology: T.W. Boecher, Danish cytogeneticist, 1909--1983; *ultraalsa* is the Latinized version of "beyond cool", referring to the striking morphology and the chilly place it inhabits, Snow Mountain.

Genus Description – Habit: Perennial herb (biennial); caudex simple or branched, persistent leaf bases generally absent; rosetted or not; rosette at ground surface or elevated on woody base; hairs simple or 2--14-rayed, stalked or sessile. Stem: simple or branched, leafy. Leaf: basal petioled, simple, generally entire or dentate, generally hairy; cauline sessile, base generally lobed, entire or dentate. Inflorescence: generally elongated. Flower: sepals bases generally not sac-like; petals generally white, lavender, or purple, claw present or 0; pollen ellipsoid in sexual pls, spheric in plants with asexual seeds. Fruit: silique, dehiscent, generally linear, edges generally parallel, unsegmented, flat parallel to septum; stigma entire or 2-lobed. Seed: in 1 or 2 rows, winged or not.

Species Description – Habit: Caudex woody. Stem: 1 per caudex branch, from center of basal rosette at +- ground surface; +- 1 dm, proximally with long-stalked, 2--6-rayed hairs generally

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0.25--0.5 mm. Leaf: basal 4--6 mm wide, entire; hairs long-stalked, 3--7 rayed, generally 0.25--0.5 mm; cauline 2--5, distal hairy, basal lobes 0. Inflorescence: 3--4-flowered, (flowers not seen), not 1-sided in fruit; fruit pedicel erect-ascending, straight, 4--5 mm, glabrous or hairs few, appressed, branched. Fruit: erect-ascending, occasionally appressed, 3--4 cm, +- 5 mm wide, glabrous; style 0.5--0.7 mm; ovules +- 16. Seed: in 1 row, 5.5--6.5 mm; wing 1--2 mm wide. eFlora Treatment Author: Michael D. Windham & Ihsan A. Al-Shehbaz.

Status:

Note: Federally recognized Endangered, Threatened, Proposed, or Candidate species under the Endangered Species Act are omitted as they do not meet the definition of a Species of Conservation Concern (FSH 1909.12 § 12.52).

State Listing	G-rank	S-rank	CRPR	R5 FSS	NFP SM	CA BLM
CA: Not listed NV: Not listed OR: Not listed	G1	CA: S1 NV: Not listed OR: Not listed	1B.1	Not listed	Not listed	Not listed
SWAP: Strategy Species	NNHP: Not listed	NNPS: Not listed	ORBIC: Not listed	OCS: Not listed	IUCN: Not listed	

Expanded abbreviations and citations: State Listing=California Endangered Species Act Listing (CDFW 2018b), Nevada Division of Forestry Fully Protected Plant Species (NAC 527) (NDF 2012), Oregon Department of Agriculture Listed Plants (ODA 2014); G-rank=Global Conservation Status (CDFW 2018a; NatureServe 2018); S-rank=Subnational (state or province-level) Conservation Status (CDFW 2018a; NatureServe 2018; NNHP 2017; ORBIC 2016); CRPR=California Rare Plant Rank (CNPS 2018); R5 FSS=USDA Forest Service Region 5 Regional Forester Sensitive Plant Species List (USDA 2013); NFP SM=Forest Service and Bureau of Land Management Northwest Forest Plan Survey and Manage Species (USDA 2001); CA BLM=California Bureau of Land Management Designated Sensitive Species (BLM 2010); SWAP=California State Wildlife Action Plan Status (CDFW 2015); NNHP=Nevada Natural Heritage Program Status (NNHP 2017); NNPS=Nevada Native Plant Society Status (NNHP 2017); ORBIC=Oregon Biological Information Center Status (ORBIC 2016); OCS=Oregon Conservation Strategy Species (ODFW 2016); IUCN=International Union for Conservation of Nature Red List Status (IUCN 2017).

Distribution: The distribution of *B. ultraalsa* is characterized as high Interior North Coast Ranges NCoRH, but it is known from one specimen made from a portion of a single plant on the west slope of Snow Mountain in Lake County (Windham and Al-Shehbaz 2006; Sims and Bittman 2011; CNPS 2018).



Sources: *Distribution:* CCH 2017, CNDDDB 2017. *Layers:* USDA Forest Service, Pacific Southwest National Forests: CPAD 2016. California counties: CDF 2009. *Basemaps:* California inset map: © 2013 National Geographic Society, i-cubed (Esri 2017a). Main map: Esri, DeLorme, USGS, NPS (Esri 2012) and Esri, USGS, NOAA (Esri 2017b).

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Locations within California:

Record numbers indicate sites that contain an individual, population, or groups of populations located within ¼ mile of each other, per the California Natural Diversity Database (CNDDDB 2017) definition of Element Occurrences (EOs) in California. Official EO numbers for plants in California are determined solely by the CNDDDB and are included within the Reference (Source) column for CNDDDB data. Duplicate records from the same site are given the same record number and included in red. The Population Info column includes total number of individuals and total number and size of populations/sub-populations when provided. Elevations provided in meters from source have been converted to feet. If not provided in original source, Land Manager information was obtained using the California Protected Areas Database (CPAD 2016) and Quad information was obtained using 24K Quads, SDE Feature Class (CDFG 2013). All other information is directly from the Reference (Source) unless additional citation is given.

Rec. #	Locality	County	Quad	Reference (Source)	Date Last Observed	Population Info	Threats	Land Manager	Elev. (ft.)
1	JUST ABOVE BEAR CREEK ON EAST SIDE, SW SIDE OF SNOW MOUNTAIN.	Lake	Potato Hill (3912237)	CNDDDB, May 2017 (EO 1)	1-Aug-1981	TYPE LOCALITY. ONLY SOURCE OF INFORMATION FOR THIS SITE IS A 1981 HECKARD & HICKMAN COLLECTION. ORIGINALLY IDENTIFIED AS ARABIS (BOECHERA) PLATYSPERMA. NEEDS FIELDWORK.		Mendocino NF	6000
1	just above (10 ft) Bear Creek (on e side, sw side of Snow Mt.); Snow Mt.	Lake	Potato Hill (3912237)	CCH, Jan 2017 (JEPS80848)	1-Aug-1981			Mendocino NF	6001

Distribution on National Forest System (NFS) Lands:

(Please see Reference column of Locations table above for references pertaining to Record Numbers indicated on NFS lands.)

National Forest System (NFS) lands	Record #s (from Locations table above)	CNDDDB EOs	Non-CNDDDB Records	Recent (seen in past 20 yrs.)	Historic (not seen in past 20 yrs.)	Most Recent Obs.	EOs/ Recs. (5 mile buffer)	Total Records on NFS lands
Angeles:	-	-	-	-	-	-	-	0
Cleveland:	-	-	-	-	-	-	-	0
Eldorado:	-	-	-	-	-	-	-	0
Inyo:	-	-	-	-	-	-	-	0
Klamath:	-	-	-	-	-	-	-	0
Lake Tahoe Basin MU:	-	-	-	-	-	-	-	0
Lassen:	-	-	-	-	-	-	-	0
Los Padres:	-	-	-	-	-	-	-	0
Mendocino:	1	1	-	-	1	1-Aug-1981	-	1
Modoc:	-	-	-	-	-	-	-	0
Plumas:	-	-	-	-	-	-	-	0
San Bernardino:	-	-	-	-	-	-	-	0
Sequoia:	-	-	-	-	-	-	-	0
Shasta-Trinity:	-	-	-	-	-	-	-	0
Sierra:	-	-	-	-	-	-	-	0
Six Rivers:	-	-	-	-	-	-	-	0
Stanislaus:	-	-	-	-	-	-	-	0
Tahoe:	-	-	-	-	-	-	-	0
Totals:	N/A	1	0	0	1	N/A	0	1

Demographic and Population Trends: *Boechea ultraalsa* is known from a single occurrence based on a 1981 herbarium specimen made by Larry Heckard (JEPS80848), and is in the Snow Mountain Wilderness on Mendocino National Forest (CNDDDB 2018).

It should be noted that this plant is perennial from a branching caudex, so its population numbers are not expected to fluctuate. However, it cannot be definitively identified unless it is bearing fruit. This species will therefore be detectable during summer to early fall (CNPS 2018).

There is no known information about demographic or population trends. Bailey (pers. comm. 2018) made a collection in 2010 from the vicinity of the Heckard holotype of a plant that had leaf shape and leaf hairs that matched the holotype but no flowers or fruits were found. This population was not censused, but was noted to be small. Tissue was collected for DNA analysis. *Boechea ultraalsa* was again sought in 2015 by a team of experienced botanists but not found

(Lazar pers. comm. 2018). Otherwise no new information has come to light about the size or status of the presumed population at Snow Mountain, nor have other populations been found (CCH 2018; Windham pers. comm. 2018).

Life History: *Boecheera ultraalsa* is a perennial herb with a branching caudex. This is inferred from the single collection (JEPS80848) from which this species is described, which consists of a portion of underground stem connected to five rosettes, two of which bear fruits. Based on flowering time of related species in the area, it is thought to bloom from June through July (CNPS 2018).

Diversity: *Boecheera* species were segregated from *Arabis* after molecular analyses (Koch et al. 2001; Mitchell-Olds et al. 2005) revealed that *Arabis* and *Boecheera* belong to distantly related clades of Brassicaceae that diverged some 19-25 million years ago. A new classification of the family (Al-Shehbaz et al. 2006) placed them in different tribes (Arabideae and Boechereae). Despite this finding of phylogenetic divergence, *Boecheera* remains a taxonomically problematic genus, with variability in leaf vestiture and fruit shape leading it to key out in three places in the Brassicaceae key in the *Jepson eFlora* (Windham and Al-Shehbaz 2012).

Within *Boecheera* there is further confusion due to variability and overlapping traits between species. A cause of the confusion is the significant portion of this genus affected by hybridization, as the sexual diploid species, despite being relatively distinct from one another, hybridize wherever they come into contact (Al-shehbaz and Windham 2012). Some *Boecheera* hybrids become stable, self-propagating lineages via apomyxis and polyploidy and those that are also morphologically discernable are being recognized as species (Schranz et al. 2005; Windham and Al-Shehbaz 2007). Most of the hybrid species are triploids, with the three genomes contributed by one to three different species (Al-shehbaz and Windham 2012). These hybrid species often occupy unique environmental niches and may enjoy selective advantages conferred by additional variant gene copies (Waters pers. comm. 2018). Morphological variability and lability of reproductive mode make this genus an attractive subject for genetic study (Rushworth et al. 2011).

When describing *B. ultraalsa*, Al-Shehbaz and Windham (2006) considered the possibility of this plant being a hybrid, but provisionally rejected that idea due its perceived distinctness, concluding that it must be a sexual diploid, although genetic data and pollen data were not available to prove ploidy level or reproductive mode (Windham and Al-Shehbaz 2006).

Bailey made a collection in 2010 from the vicinity of the Heckard holotype of a *Boecheera* that had leaf shape and leaf hairs that matched the holotype but no flowers or fruits (Bailey pers. comm. 2018). The collection made by Bailey proved to be an apomictic triploid composed of three slightly divergent *B. platysperma* genomes. Until plants from the site of this analyzed collection are found in flower and fruit; however, their relationship to the Heckard holotype remains conjectural, and there is insufficient surplus tissue available on the Heckard holotype to conduct a similar genomic analysis (Windham pers. comm. 2018).

Habitat: The habitat of *B. ultraalsa* is characterized on the specimen and in Larry Heckard's field notes (Heckard 1981) as a steep, dry bank in scree and coarse soil, 10 feet above Bear Creek on the east side of the creek, at an elevation of 1,800 meters. The substrate was not noted by the collector, but Snow Mountain surficial geology is unusual, consisting primarily of submarine (Franciscan Complex) volcanic and metavolcanic rocks (California Dept. of Conservation 2010).

Associated species noted are: *Eriogonum compositum*, *Hydrophyllum occidentale*, and *Monardella glauca*. In the larger area, the dry slopes are sparse microphyllous shrubland with *Holodiscus boursieri* and *Purshia tridentata*. In the adjacent Bear Creek drainage are occasional *Cornus stolonifera*, *Lonicera involucrata*, *Salix lasiolepis*, and *Salix sitchensis* var. *parvifolia* (Heckard 1981).

Habitat Status or Trend: Reduced moisture availability (increasing snowline elevation, reduced snowmelt) and increasing warm temperature anomalies associated with climate change in California (OEHHA 2018) may impact *B. ultraalsa*, as it was found in a relatively dry habitat at approximately snowline within the relatively small watershed that is Snow Mountain.

Capacity for the Species to Disperse: Pollen dispersal/pollinator studies were not found for *B. ultraalsa* or for *Boecheera*. The pollinator(s) is/are unknown for this recently described, and little-studied genus (Waters pers. comm. 2018). Schranz (2005) found that apomyxis in *Boecheera* requires fertilization, so pollen dispersal is an important factor whether or not *B. ultraalsa* is a sexual species. The only known specimen of *B. ultraalsa* has fruits only, so reproductive mode cannot be assessed (Windham and Al-Shehbaz 2006). *Boecheera ultraalsa* is probably a sexual diploid (Al-Shehbaz and Windham 2012).

For *Boecheera*, *B. ultraalsa* has an exceptionally large seed (5.5-6.5 mm diameter) approximately half of which diameter taken up by the 1-2 mm wide wing, which encircles the periphery of the flat, circular seed (Windham and Al-Shehbaz 2012). This type of seed structure produces considerable lift, even in light winds, making this seed is theoretically capable of a significant linear trajectory, similar to that of glider planes or frisbees (Burrows 1975).

Boecheera ultraalsa, even if not unique to Snow Mountain, is at risk from poor connectivity with other populations outside of Snow Mountain, as this site is the southernmost point in the North Coast Ranges that has permanent snowfields, and is isolated from other similarly high peaks. For example, its closest relative, *B. platysperma*, occurs in several sites on Snow Mountain, but the nearest cluster of records is on Hull Mt., 15 km to the northwest (CCH 2018).

Threats: The entire known range of *B. ultraalsa* occurs within a creek drainage well within a designated Wilderness Area (Snow Mountain Wilderness), the wilderness status of which is under threat of revocation. In this area, there are currently few roads and trails, and none reported adjacent to the collection site (Heckard 1981; Bailey pers. comm. 2018). The entire area, including the area of both the *B. ultraalsa* holotype collection and the subsequent Bailey collection of the apomictic triploid, burned during the Ranch Fire in August of 2018 (CDF 2018).

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Persons Contacted:

Bailey, C. D. 2018. Associate Professor of Biology, New Mexico State University, Las Cruces, NM. Email communication about *Boechera ultraalsa* collections. Personal communication 18 October 2018.

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Formatting: Form is set up as 508 compliant. Please use the “styles” if further formatting is necessary.

Purpose: This is to maintain the best available science on a species that could be used by the Forest Service in a variety of functions. Specifically, there would be additional steps and evaluations to determine whether or not this species would be considered a Species of Conservation Concern under the 2012 Planning Rule or a Sensitive Species under the 1982 Planning Rule.

Additional Considerations at the Forest Level: Habitat amount and juxtaposition of both the species and habitat locations.