Plant Species Evaluation Form

Lupinus antoninus Eastw.

ANTHONY PEAK LUPINE

Family: Fabaceae (CNPS 2017)

PLANTS Symbol: LUAN5 (USDA 2017)

Calif. Endemic: Yes (CNPS 2017)

Synonyms/Other Names: *Lupinus antoninus* was described by Alice Eastwood in 1943 (Tropicos 2017; Eastwood 1943). No other names have been assigned to this entity.

Identification Issues: Eastwood's original description for this taxon includes a declaration that *L. antoninus* is an additional member of the "puzzling" *L. formosus* group (Eastwood 1943). *Lupinus formosus* is fairly widespread, occurring in the Coast Ranges, Central and Southern Sierra, and the Transverse Ranges. Based on collection and observation data, *L. formosus* occurs near *L. antoninus* (CCH 2017; Calflora 2017). *Lupinus formosus* generally occurs in valleys, whereas *L. antoninus* is usually found in mountainous habitat. In addition, *L. formosus* develops rhizomes and sprouts from below ground. This behavior is not observed in *L. antoninus*, considering that it does not produce rhizomes and it generally resprouts from aboveground tissue (Sholars 2017). The petals of *L. antoninus* are white and become tawny at full bloom (Eastwood 1943).

Taxonomy:

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Species In Genus: +- 220 species: especially western North America, western South America to eastern United States, also tropical South America, Mediterranean to western Asia, eastern tropical Africa; some cultivated for fodder, green manure, edible seed, ornamental. Etymology: (Latin: wolf, from mistaken idea that plants rob soil of nutrients). Toxicity: Some (e.g., Lupinus arboreus, Lupinus latifolius, Lupinus leucophyllus) have alkaloids (especially in seeds, fruits, young herbage) TOXIC to livestock (especially sheep). Note: Inflorescence length excludes peduncle; some California species naturalized in eastern North America, South America, Australia, southern Africa.

Genus Description Habit: Annual to shrub; cotyledons generally petioled, withering early. Stem: generally erect. Leaf: palmately compound [or not], generally cauline; stipules fused to petiole; leaflets 3--17, generally oblanceolate, entire. Inflorescence: raceme, flowers spiraled or whorled, occasionally also in lower leaf axils; bracts generally deciduous. Flower: calyx 2-lipped, lobes entire or toothed, generally appendaged between; corolla blue, purple, white, or yellow, banner glabrous to densely hairy, centrally grooved, sides reflexed, wing tips +- fused, keel generally beaked; stamens 10, filaments fused, 5 long with short anthers, 5 short with long anthers; style brush-like. Fruit: dehiscent, generally oblong. Seed: 2--12, generally smooth.

Species Description Habit: Perennial herb 2--5 dm, gray- to silver-hairy. Stem: erect. Leaf: cauline; stipules 10--12 mm; petiole 1--2 cm; leaflets 6--7, 15--25 mm. Inflorescence: 4--20 cm,

open, flowers spiralled; peduncle +- 1--4 cm; pedicels 3--4 mm; bracts 7--8 mm, +- deciduous. Flower: 12--14 mm; calyx upper lip 6--8 mm, 2-toothed, lower 6--8 mm, 3-toothed; petals white, banner back glabrous, spot turning tawny, keel glabrous. Fruit: 2.5--3.5 cm, 14--17 mm wide, silky. Seed: 4--5, 7--11 mm, mottled brown. eFlora Treatment Author: Teresa Sholars.

Status:

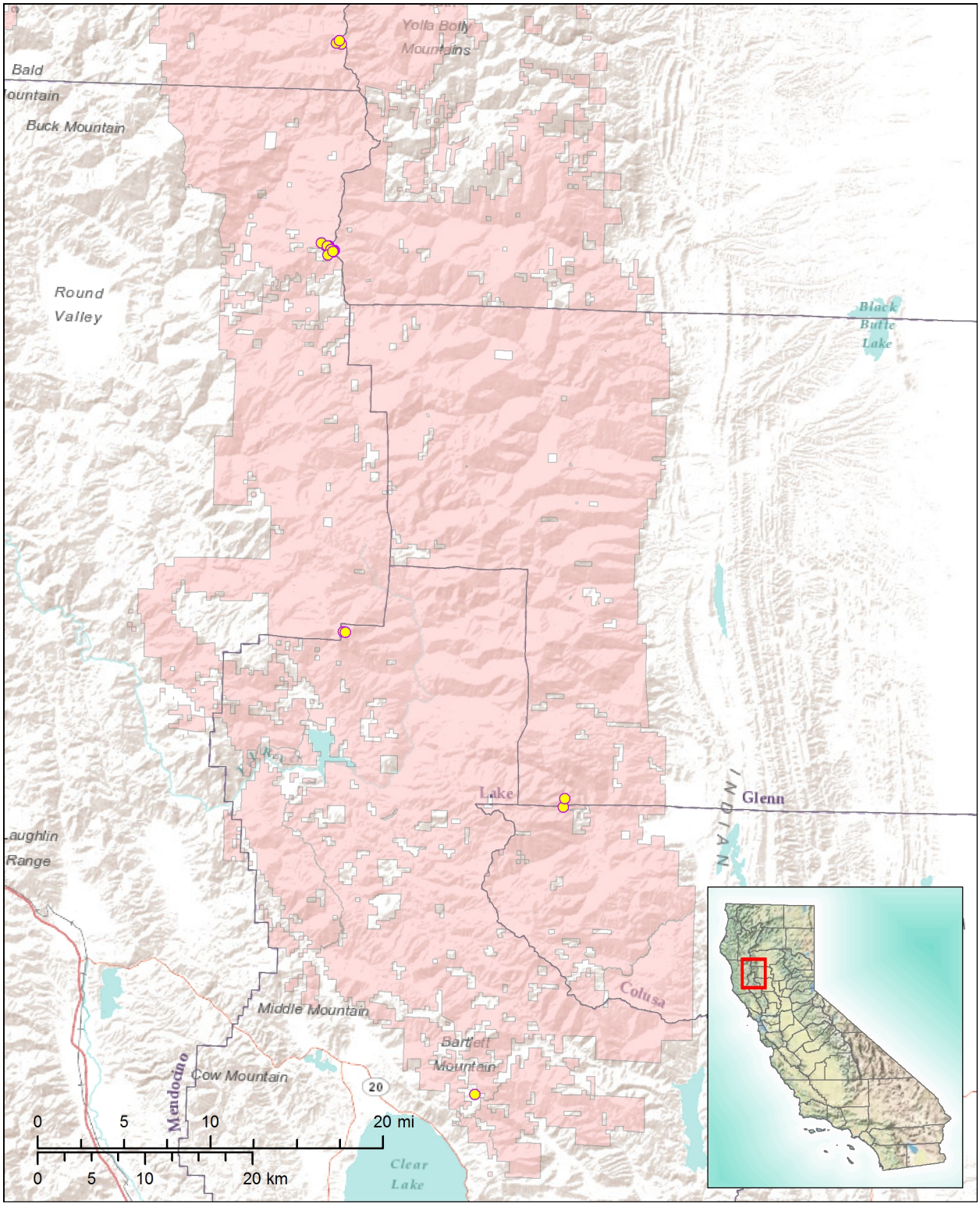
Note: Federally recognized Endangered, Threatened, Proposed, or Candidate species under the Endangered Species Act are omitted as they do not meet the definition of a Species of Conservation Concern (FSH 1909.12 § 12.52).

State Listing	G-rank	S-rank	CRPR	R5 FSS	NFP SM	CA BLM
CA: Not listed NV: Not listed OR: Not listed	G2	CA: S2 NV: Not listed OR: Not listed	1B.3	Sensitive	Not listed	Not listed

SWAP:	NNHP:	NNPS:	ORBIC:	OCS:	IUCN:
Not listed	Not listed	Not listed	Not listed	Not listed	Not listed

Expanded abbreviations and citations: State Listing=California Endangered Species Act Listing (CDFW 2017b), 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 2017a; NatureServe 2017); S-rank=Subnational (state or province-level) Conservation Status (CDFW 2017a; NatureServe 2017; NNHP 2017; ORBIC 2016); CRPR=California Rare Plant Rank (CNPS 2017); 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: This taxon is entirely restricted to California, a California endemic, and is found in Mendocino, Tehama, Trinity, Lake, Colusa, and Glenn counties. Plants from all eight records of this taxon occur in the North Coast Range within the Mendocino NF (CNDDB 2017; Griffin et al. 2016).



Basemap Sources: Main map: Esri, DeLorme, USGS, NOAA, NPS. California inset map: © 2013 National Geographic Society, i-cubed.

Locations within California:

(Note: 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 (CNDDB) definition of Element Occurrences in California). Official Element Occurrence (EO) numbers for plants in California are determined solely by the CNDDB and are included within the Reference (Source) column for CNDDB 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 in meters from source were 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) column unless additional citation is given.)

Rec. #	Locality	County	Quad	Reference (Source)	Date Last Observed	Population Info	Threats	Land Manager	Elev. (ft.)
1	ANTHONY PEAK ON N SIDE OF SPUR RIDGE, NW OF SUMMIT.	Mendocino	Mendocino Pass (3912278)	CNDDB, May 2017 (EO 1)	3-Aug-1995	TYPE LOCALITY. 20-30 PLANTS IN 1985, 36 IN 1987, AND 35 IN 1995. ALL PLANTS DID NOT KEY OUT PERFECTLY TO L. ANTONINUS; SOME APPEARED TO BE HYBRIDS WITH L. ALBIFRONS SSP. COLLINUS IN 1995. L. ANDERSONII ALSO OCCURS HERE.		Mendocino NF	6900
1	Mendocino--Tehama Co. Anthony Peak	Mendocino	Mendocino Pass (3912278)	CCH, Jan 2017 (CAS300988)	10-Jul-1941			Mendocino NF	
1	Mendocino--Tehama Co. Anthony Peak	Mendocino	Mendocino Pass (3912278)	CCH, Jan 2017 (CAS300989)	10-Jul-1941			Mendocino NF	
1	Anthony Peak, ridgeline ca. 400 m NW of summit	Mendocino	Mendocino Pass (3912278)	CCH, Jan 2017 (CHSC67654)	22-Jun-1985			Mendocino NF	6601

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Rec. #	Locality	County	Quad	Reference (Source)	Date Last Observed	Population Info	Threats	Land Manager	Elev. (ft.)
1	Anthony Peak, ridgeline ca. 400 m. NW of summit; T23N R10W center E1/2 Sect. 16	Mendocino	Mendocino Pass (3912278)	CCH, Jan 2017 (UCSB63571)	22-Jun-1985			Mendocino NF	6598
1	Mendocino National Forest--North Coast Ranges. Upper Middle Fork Eel River Watershed. About 250 yards N of Anthony Peak lookout on East edge of ridgetop	Mendocino	Mendocino Pass (3912278)	CCH, Jan 2017 (CHSC91505)	3-Aug-1995			Mendocino NF	6759
1	Mendocino-Tehama Counties, Anthony Peak	Mendocino	Mendocino Pass (3912278)	CCH, Jan 2017 (GH65431)	10-Jul-1941			Mendocino NF	
1	Anthony Peak, Mendocino - Tehama County	Mendocino	Mendocino Pass (3912278)	CCH, Jan 2017 (RSA104772)	10-Jul-1941			Mendocino NF	

Rec. #	Locality	County	Quad	Reference (Source)	Date Last Observed	Population Info	Threats	Land Manager	Elev. (ft.)
2	IN SADDLE DUE W OF LAST CAMP, ~0.5 MILE S OF SOLOMON PEAK SUMMIT.	Tehama | Trinity	Solomon Peak (4012218)	CNDDB, May 2017 (EO 2)	18-Jul-1987	20 PLANTS IN 1987; DID NOT KEY OUT PERFECTLY TO L. ANTONINUS. A 1980 JOKERST COLLECTION IS ALSO ATTRIBUTED TO THIS OCCURRENCE.		Mendocino NF	7400
2	North Coast Range. Near Solomon Peak. [Latitude on label (22 degrees 46' 2" N) is very incorrect. Substituted value is for Solomon Peak on the Yolla Bolly SW quad.]	Trinity	Solomon Peak (4012218)	CCH, Jan 2017 (CHSC32229)	20-Aug-1980			Mendocino NF	
2	North Coast Range. Near summit of Hull Mt. ca 300 met NE at crest of ridge	Lake	Hull Mountain (3912258)	CCH, Jan 2017 (CHSC38951)	10-Jul-1980			Mendocino NF	984
3	CREST AND SIDES OF RIDGE NE OF SUMMIT OF HULL MOUNTAIN.	Lake	Hull Mountain (3912258)	CNDDB, May 2017 (EO 3)	10-Jul-1980	20-40 PLANTS OBSERVED IN 1980.		Mendocino NF	6640

Rec. #	Locality	County	Quad	Reference (Source)	Date Last Observed	Population Info	Threats	Land Manager	Elev. (ft.)
4	ROAD TO PINNACLE ROCK, LAKE COUNTY.	Lake	Bartlett Mtn. (3912227)	CNDDB, May 2017 (EO 4)	XXXXXXXX	ONLY SOURCE OF INFORMATION FOR THIS SITE IS LOCATION MENTIONED IN MILO BAKER'S "A PARTIAL LIST OF SEED PLANTS OF THE NORTH COAST RANGE OF CALIFORNIA" ACCORDING TO JOKERST. NEEDS FIELDWORK.		Mendocino NF	4000
5	SE SIDE OF SNOW MOUNTAIN ABOVE BONNIE VIEW.	Colusa | Glenn	St. John Mtn. (3912246)	CNDDB, May 2017 (EO 5)	7-Jun-1919	ONLY SOURCE OF INFORMATION FOR THIS SITE IS A 1919 HELLER COLLECTION. NEEDS FIELDWORK.		Mendocino NF	
5	Lake County: SE side of Snow Mountain above Bonnie View	Glenn	St. John Mtn. (3912246)	CCH, Jan 2017 (UCD105751)	7-Jun-1919			Mendocino NF	
6	HOGBACK ABOUT 0.5 MILE S OF LOOKOUT, ANTHONY PEAK.	Mendocino | Tehama	Mendocino Pass (3912278)	CNDDB, May 2017 (EO 6)	8-Aug-1943	ONLY SOURCES OF INFORMATION FOR THIS SITE ARE TWO 1943 COLLECTIONS BY BAKER AND HOWELL. NEEDS FIELDWORK.		Mendocino NF	6700

Rec. #	Locality	County	Quad	Reference (Source)	Date Last Observed	Population Info	Threats	Land Manager	Elev. (ft.)
6	Hogback, 0.5 miles S of Lookout, Anthony Peak	Mendocino	Mendocino Pass (3912278)	CCH, Jan 2017 (RSA74450)	8-Aug-1943			Mendocino NF	6703
6	Anthony Peak, on W side of ridge S of summit	Mendocino	Mendocino Pass (3912278)	CCH, Jan 2017 (CAS312470)	8-Aug-1943			Mendocino NF	
6	Anthony Peak, on W side of ridge S of summit	Mendocino	Mendocino Pass (3912278)	CCH, Jan 2017 (DS311535)	8-Aug-1943			Mendocino NF	
6	Hogback ca 1/2 mi. S of Lookout, Anthony Peak	Mendocino	Mendocino Pass (3912278)	CCH, Jan 2017 (DS318110)	8-Aug-1943			Mendocino NF	6699
6	Hogback ca 1/2 mi. S of Lookout, Anthony Peak	Mendocino	Mendocino Pass (3912278)	CCH, Jan 2017 (DS559719)	8-Aug-1943			Mendocino NF	6699
6	Mendocino Anthony Peak, on W side of ridge S of summit	Mendocino	Mendocino Pass (3912278)	CCH, Jan 2017 (GH366743)	8-Aug-1943			Mendocino NF	
6	Anthony Peak, on W side of ridge S of summit	Mendocino	Mendocino Pass (3912278)	CCH, Jan 2017 (RSA40230)	8-Aug-1943			Mendocino NF	

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Rec. #	Locality	County	Quad	Reference (Source)	Date Last Observed	Population Info	Threats	Land Manager	Elev. (ft.)
6	ca 0.5 mi S of Lookout (Hogback, Anthony Peak); Anthony Peak	Mendocino	Mendocino Pass (3912278)	CCH, Jan 2017 (UC728693)	8-Aug-1943			Mendocino NF	6699
7	Anthony Peak;	Mendocino	Mendocino Pass (3912278)	NRIS, Sep 2016 (050856LUAN5002)	9-Aug-2010	24 individuals		Mendocino NF	
8	SOLOMON PEAK, 100 METERS N OF LAST SADDLE S OF THE SUMMIT, YOLLA BOLLY WILDERNESS.	Trinity	Solomon Peak (4012218)	NRIS, Sep 2016 (050856LUAN5001)	1-Jan-1903	individuals		Mendocino NF	

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)	CNDDB EOs	Non-CNDDB 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, 2, 3, 4, 5, 6, 7, 8	6	2	1	7	9-Aug-2010	0	8
Modoc:	-	-	-	-	-	-	-	0
Plumas:	-	-	-	-	-	-	-	0
San Bernardino:	-	-	-	-	-	-	-	0
Sequoia:	-	-	-	-	-	-	-	0
Shasta-Trinity:	-	-	-	-	-	-	-	0
Sierra:	-	-	-	-	-	-	-	0
Six Rivers:	-	-	-	-	-	-	-	0
Stanislaus:	-	-	-	-	-	-	-	0
Tahoe:	-	-	-	-	-	-	-	0
Totals:	N/A	6	2	1	7	N/A	0	8

Demographic and Population Trends: The observation of roughly 135 individual plants has been documented across eight separate occurrences between 1903 and 2010. Element Occurrence one (EO1) had 36 plants in 1987 and roughly the same number in 1995. Element Occurrence 3 (EO 3) had between 20-40 plants in 1980. In 1980, 24 plants were documented at the site of record #24 (CNDDB 2017; NRIS 2017). The remaining occurrences lack population level information.

Life History: *Lupinus antoninus* is a perennial herb that blooms from May until July (CNPS 2017). Plants lacking rhizomes are known to resprout aboveground. *Lupinus* is a nitrogen fixing legume that develops root nodules that house diazotrophic microbes. These microbes are able to fix atmospheric nitrogen into bioavailable ammonia, which the parent plant incorporates into its tissues. Nitrogen fixation in legumes also enriches soil fertility around the host plant through the decomposition of aged roots and nodules (Ledgard and Steele 1992). Certain members of *Lupinus* are known to be toxic to livestock (Keeler and Panter 1989). Little is known about the life history of this rare taxon. *Lupinus antoninus* is allied with a group of western North American perennials. One of these perennials, *L. latifolius*, is insect pollinated, is known to be visited by bees, and is also suspected to form a seed bank. Dispersal of *L. latifolius* seeds from dehisced fruit is limited given the large size of its seed. Seedlings emerge within a short distance of parent plants (Reeves 2006). *Lupinus antonius* seeds are substantially larger than *L. latifolius* seeds (Scholars 2017). *Lupinus latifolius* is known to respond favorable and to resprout after fire, generating new tissue from its deeply penetrating rootstock (Reeves 2006). *Lupinus antoninus* is also a taxon that is considered to resprout, based on information presented in the key associated with the *Lupinus* treatment in the Jespon eFlora (Sholars 2017).

Diversity: *Lupinus* is a prominent member of the Faboideae. This subfamily is represented by upward of 500 genera and ca. 14,000 species with zygomorphic flowers that have a prominent banner sitting outside the lateral wings, have dry and elongate fruit that dehisce along two edges, and produce nodule forming roots that house diazotrophic microbes (Stevens 2001; Sholars 2017). *Lupinus* is a group of roughly 250 species in the Genisteae (Drummond 2008; Stevens 2001). The Genisteae is a tribe of roughly 25 northern temperate genera. Plants commonly referred to as "brooms" or "gorse" in the genera *Cytisus, Genista*, and *Ulex* are also members of this tribe alongside *Lupinus* (Stevens 2001). Roughly 12 species of *Lupinus* are found in Mediterranean Europe. Eastern South America is home to roughly 24 species, whereas eight are found in eastern North America. A bulk of the diversity is represented by taxa in the highlands of Mexico and Central America (~30 species), the Andes of western South America (~85 species), and western North America in the Rockies, Great Basin, and along the Pacific slope (~88 species). Studies on molecular divergence times of taxa in the Fabaceae demonstrate that *Lupinus* and *Spartium* split nearly 16.0 Mya. Data based on cpDNA suggest that *Lupinus* arose 5.8-10.0 Mya, long after the breakup of Gondwanaland (100 Mya) and the breakdown of the North Atlantic land bridge (50 Mya). This suggests that amphi-Atlantic distributions are best explained by long-distance dispersal. Mapping of ancestral biogeography places the origin of *Lupinus* in the Old World, indicating later migration into the New World and subsequent radiation among the species-rich western New World clade (200 of the roughly 250 species in *Lupinus*). Andean-Mexican perennials and western North American perennials occupy a single clade among the western New World taxa, where each regional subclade underwent respective radiations 0.8-3.4 Mya and 0.7-2.1 Mya. Speciation rates among both Andean-Mexican and Western North American subclades are substantially higher than what is measured elsewhere. The positive correlation between perennials and high elevation habitat suggests that speciation in these perennial groups is linked to habitat formation as a result of uplift of the Andes (2-4 Mya) and the mountain ranges of the Pacific Slope (2-5 Mya) (Drummond 2008). *Lupinus antoninus* is

member of the "puzzling" *L. formosus* group (Eastwood 1943). *Lupinus formosus* is a member of a strongly supported clade (Bayesian posterior probability of 1.0 based on three cpDNA intergenic spacer regions) that includes *L. albifrons, L. arboreus, L. chamissonis, L. argenteus, L. latifolius*, and *L. polyphyllus* (Drummond 2008). A detailed investigation into the western North American perennials increased sampling of taxa in this clade, demonstrating unequivocally that *L. albifrons* is not monophyletic and that *L. formosus* haplotypes are polymorphic. Incomplete lineage sorting, hybridization, and gene exchange among taxa is highly likely under a rapid radiation scenario of this nature (Huang and Friar 2011).

Habitat: *Lupinus antoninus* is found on rocky substrates, often in talus and scree, in openings of lower and upper montane coniferous forests of the northern Coast Ranges of California (CNPS 2017; CNDDB 2017; NatureServe 2017). This taxon is reported to grow alongside *Penstemon purpusii, Chrysothamnus nauseosus, Fritillaria* spp., *Lesquerella occidentalis, Astragalus whitneyi* var. *siskiyouensis*, *Arctostaphylos nevadensis, A. uva-ursi, Quercus* spp., *Rhamnus* spp., and *Ceanothus* spp. (CNDDB 2017). Sources also indicate that *L. antoninus* has an affinity for lodgepole pine, red fir, and yellow pine forests (NatureServe 2017).

Habitat Status or Trend: *Lupinus antoninus* is a CRPR 1B.3 California endemic that is considered imperiled (G2/S2) throughout its range (CNPS 2017). It is known from a limited number of higher elevation occurrences, and is represented by 85 known plants that are considered outside the influence of threat from direct human activity. These higher elevation plants are considered threatened by the longer term impacts and the trajectory of this habitat type under the influence of a changing climate (NatureServe 2017). Hybridization with *L. albifrons* var. *collinus* is suspected at the location of a single occurrence (CNDDB 2017; CNPS 2017; NatureServe 2017).

Capacity for the Species to Disperse: Dispersal of *L. antoninus* is suspected to be limited. Dispersal of the related *L. latifolius* is known to be limited given the large size of its seed. Seedlings of *L. latifolius* emerge within a short distance of parent plants (Reeves 2006). *Lupinus antonius* seeds are substantially larger than *L. latifolius* seeds (Scholars 2017).

Threats: *Lupinus antoninus* is considered threatened by climate change and putative hybridization with closely related plants that occur in sympatry (CNDDB 2017; CNPS 2017; NatureServe 2017).

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Persons Contacted:

Sholars, T. 2017. Professor, College of the Redwoods, Eurekea, CA. Information attained via email communication, Sacramento, CA. October 2017.

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November 29, 2017

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November 29, 2017

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.