Plant Species Evaluation Form

Lupinus constancei T.W. Nelson & J.P. Nelson

THE LASSICS LUPINE

Family: Fabaceae (CNPS 2017)

PLANTS Symbol: LUCO7 (USDA 2017)

Calif. Endemic: Yes (CNPS 2017)

Synonyms/Other Names: Prior to its name being published, *Lupinus constancei* was referenced as *L. humboldtensis* T.W. Nelson & J.P. Nelson, ined. when added to the second edition of the CNPS *Inventory* (Smith et al. 1980). It was later formally described as *L. constancei* in 1983 by Thomas and Jane Nelson (Nelson and Nelson 1983; Tropicos 2017). Fifteen years later (in 1998), it was assigned the name *L. lepidus* var. *constancei* by Duane Isely (Imper 2016; Tropicos 2017). However, contemporary sources refer to the entity by its basionym (Imper 2016; Sholars 2017).

Identification Issues: The original authors declared that *L. constancei* is part of the cespitose lupine complex of western North America, and that it most closely resembles the entity now referred to as *L. lepidus* var. *sellulus* (Nelson and Nelson 1983; Tropicos 2017). Distribution maps indicate that *L. lepidus* var. *sellulus* occurs in the vicinity of *L. constancei*. It is worth noting that *L. constancei* is distinguished from allied taxa by its short erect stem, its short thick raceme, bicolored flowers, prostrate leaves, glabrous keel, large spathulate leaf segments, long petioles, and deciduous bracts. It also has a branched and woody caudex that retains the remains of old petiole attachments (Nelson and Nelson 1983; Sholars 2017).

Taxonomy:

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 < 1.5 dm, matted, long-shaggy-hairy. Stem: +- prostrate. Leaf: cauline, generally clustered near base; stipules < 6 mm; petiole 6--8(14) cm; leaflets 6--7, 10--20 mm, 8--10 mm wide. Inflorescence: 3--5 cm, dense; peduncle < 4 cm; pedicels 1--4 mm; bract 2.5--3 mm. Flower: 8--12 mm; calyx upper lip 4--5 mm, notched, lower 4--5 mm, entire; petals pink, banner back glabrous, strongly reflexed, spot light yellow, keel dark rose (white at claw), upper margins ciliate, lower glabrous. Fruit: 1.5--2.5 cm, 0.5--1 cm wide, shaggy-hairy. Seed: 3--5, tan. 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: Candidate Endangered NV: Not listed OR: Not listed	G1	CA: S1 NV: Not listed OR: Not listed	1B.2	Sensitive	Not listed	Not listed

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

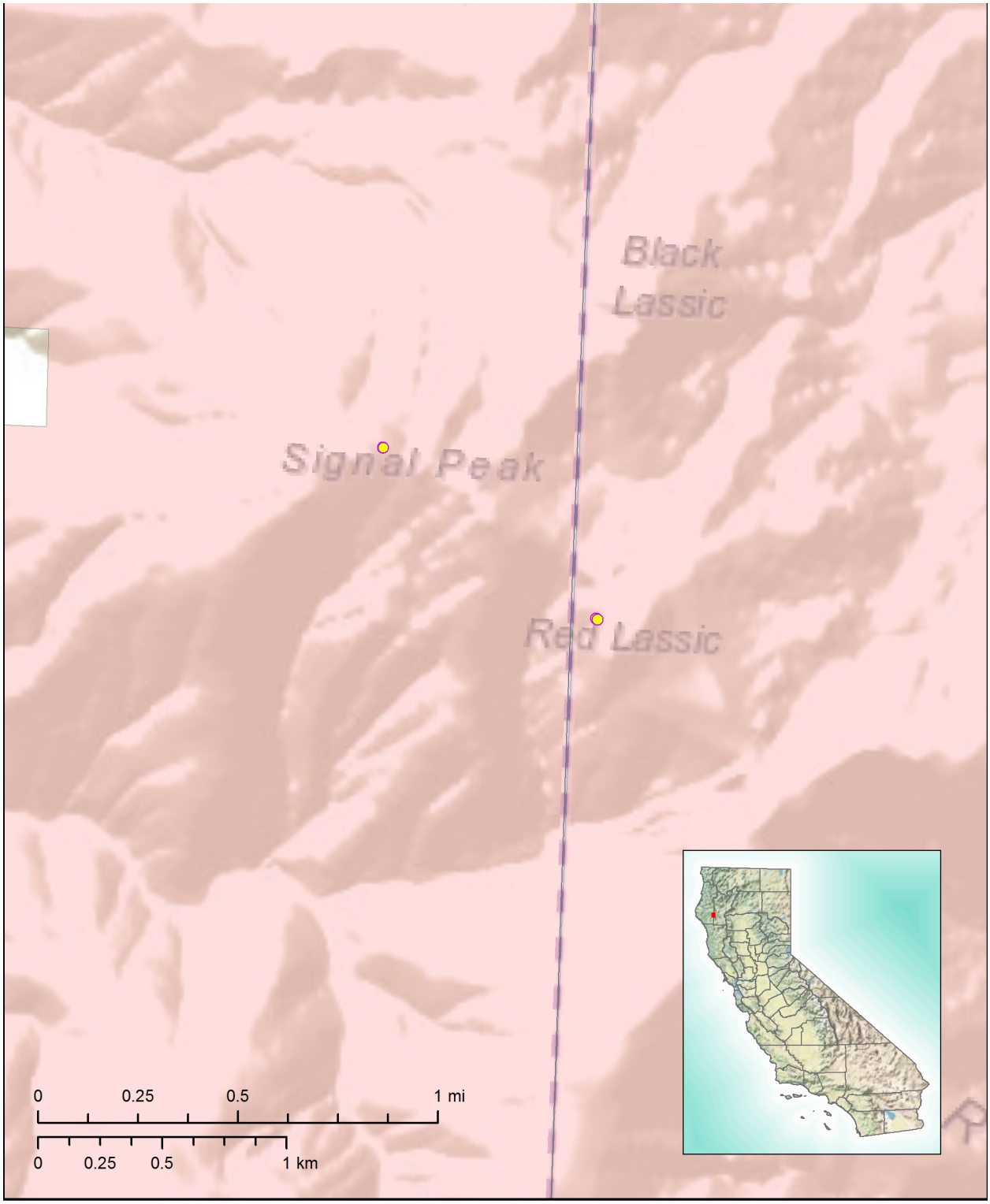
Expanded abbreviations and citations: State Listing=California Endangered Species Act Listing (CDFW 2017b), Nevada Division of Forestry Fully Protected Plant Species (NAC 527) (NDF 2012), Oregon Department of Agriculture Listed Plants (ODA 2014); G-rank=Global Conservation Status (CDFW 2017a; NatureServe 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).

Lupinus constancei was first added to the CNPS *Inventory* in 1980 as *L. humboldtensis* ined., receiving an equivilent of California Rare Plant Rank 1B, which it has maintained in the CNPS *Inventory* ever since (Smith et al. 1980; CNPS 2017). Once formerly published in 1983, it's name changed to *L. constancei* in subsequent editions of the CNPS *Inventory*. On September 27, 2017, the threat rank of *L. constancei* was changed from 0.2 (moderately threatened in California) to 0.1 (seriously threatened in California) in the CNPS *Inventory* (CNPS 2017) based on a review of threats to this species included in a petition to list it as Federally Endangered.

A petition to list *Lupinus constancei* as Endangered under the Federal Endangered Species Act was submitted to U.S. Fish and Wildlife Service (USFWS) on January 15, 2016 (USFWS 2016). Eight months afterwards, on September 14, 2016, a 90-day finding was published in the Federal Register and the species is currently in Under Review status by USFWS (USFWS 2016, 2018).

Lupinus constancei was later petitioned for State-listing as Endangered under the California Endangered Species Act on July 19, 2016 (FGC 2016), and has subsequently been treated as a State Candidate for Endangered status listing since February 8, 2017 (FGC 2017).

Distribution: *Lupinus constancei* occurs entirely within the boundaries of the Lassics Botanical and Geologic Special Interest Area of the Six Rivers National Forest. This area is within the Lassics Mountain Range. All plants are restricted to two element occurrences on Mt. Lassic (Signal Peak) and Red Lassic (Imper 2016; CNDDB 2017; CCH 2017; NRIS 2017; Calflora 2017).



Sources: *Distribution*: Calflora 2017, CCH 2017, CNDDB 2017, NRIS 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).

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 verbatim from the original Reference (Source) unless additional citation is given.

Rec. #	Locality	County	Quad	Reference (Source)	Date Last Observed	Population Info	Threats	Land Manager	Elev. (ft.)
1	MOUNT LASSIC (SIGNAL PEAK).	Humboldt	Black Lassic (4012335)	CNDDB, May 2017 (EO 1)	5-Aug-2016	TYPE LOCALITY. UNK # IN 1997, 227 PLANTS IN 2001, 33 IN 2003, 81 IN 2004, 85 IN 2005, 158 IN 2006, 110 IN 2007, 179 IN 2008, 244 IN 2009, 186 IN 2010, 398 IN 2011, 428 IN 2012, 373 IN 2013, 297 IN 2014, 160 IN 2015, <100 SURVIVED IN 2016.	ATV TRACKS IN 2001 & 2003. INTENSIVE SEED PREDATION/ HERBIVORY (ADULTS CAGED), DROUGHT/ CLIMATE WARMING, FIRE (2015).	Six Rivers NF	5700
1	Mt. Lassic and two smaller peaks to immediate E	Humboldt	Black Lassic (4012335)	CCH, Jan 2017 (HSC32156)	14-Jun-1972			Six Rivers NF	5801
1	The Lassics - Mt. Lassic (Signal Peak)	Humboldt	Black Lassic (4012335)	Calflora, May 2017 (jgr16820)	23-Jun-1990	1+ individuals		Six Rivers NF	5787
1	Mt. Lassic	Humboldt	Black Lassic (4012335)	Calflora, May 2017 (po2503)	1-Jun-2015	11 - 50 individuals		Six Rivers NF	5738

Rec. #	Locality	County	Quad	Reference (Source)	Date Last Observed	Population Info	Threats	Land Manager	Elev. (ft.)
1	Mt. Lassic	Humboldt	Black Lassic (4012335)	Calflora, May 2017 (po2504)	1-Jun-2015	51 - 100 individuals		Six Rivers NF	5784
1	Mt. Lassic (Signal Peak) and saddle to e North Coast Ranges, Blockburg Quad., Mt. Lassic (Signal Peak; Blocksburg Quadrangle on Mt. Lassic (Signal Peak), Humboldt Co.	Humboldt	Black Lassic (4012335)	CCH, Jan 2017 (JEPS82142)	9-Jul-1982			Six Rivers NF	5801
1	Blocksburg Quadrangle. Mt. Lassic (Signal Peak) and saddle to east.	Humboldt	Black Lassic (4012335)	CCH, Jan 2017 (CAS685799)	9-Jul-1982			Six Rivers NF	
1	Blocksburg Quadrangle, T1S, R5E, Sec. 36, serpentine barrens on Mount Lassic (Signal Peak) and saddle to east	Humboldt	Black Lassic (4012335)	CCH, Jan 2017 (GH65480)	9-Jul-1982			Six Rivers NF	5801
1	Mt. Lassic (Signal Peak) and saddle to E	Humboldt	Black Lassic (4012335)	CCH, Jan 2017 (HSC79474)	9-Jul-1982			Six Rivers NF	5801

Rec. #	Locality	County	Quad	Reference (Source)	Date Last Observed	Population Info	Threats	Land Manager	Elev. (ft.)
1	Blocksburg quadrangle. Sepentine barrens on Mt. Lassic (Signal Peak) and saddle to east.	Humboldt	Black Lassic (4012335)	CCH, Jan 2017 (NY15833)	9-Jul-1982			Six Rivers NF	5801
1	near Trinity Co. line (The Lassics, Lassic Peak); The Lassics, Lassic Peak	Humboldt	Black Lassic (4012335)	CCH, Jan 2017 (JEPS83709)	26-Jul-1987			Six Rivers NF	5699
1	Humboldt/Trinity County line, Mt. Lassic (Signal Peak)	Humboldt	Black Lassic (4012335)	CCH, Jan 2017 (HSC36191)	10-Jul-1973			Six Rivers NF	5873
1	Six Rivers NF	Humboldt	Black Lassic (4012335)	NRIS, Feb 2017 (510470026)	1-Jul-1997	0 individuals		Six Rivers NF	
1	Mt. Lassic;	Humboldt	Black Lassic (4012335)	NRIS, Feb 2017 (510470026)	15-Jul-2015	276 individuals		Six Rivers NF	
1	Six Rivers NF	Humboldt	Black Lassic (4012335)	NRIS, Feb 2017 (510470026)	6-Jun-2001	646 individuals		Six Rivers NF	

Rec. #	Locality	County	Quad	Reference (Source)	Date Last Observed	Population Info	Threats	Land Manager	Elev. (ft.)
2	RED LASSIC, SE OF MOUNT LASSIC (SIGNAL PEAK).	Trinity	Black Lassic (4012335)	CNDDB, May 2017 (EO 3)	5-Aug-2016	UNK # IN 1997, 200 IN 2003, 250 IN 2004, 400 IN 2005, 430 IN 2006, 462 IN 2007, 469 IN 2008, 551 IN 2009, 358 IN 2010, 620 IN 2011, 780 IN 2012, 984 IN 2013, 807 IN 2014, 443 IN 2015. IN 2016, ALL ADULTS DEAD, 72 SEEDLINGS COUNTED.	INTENSIVE SEED PREDATION AND HERBIVORY, DROUGHT/ CLIMATE WARMING (2015). FIRE BURNED THROUGH SITE IN JULY/AUG 2015.	Six Rivers NF	5540
2	Six Rivers NF	Trinity	Black Lassic (4012335)	NRIS, Feb 2017 (510470028)	12-Jun-2001	51 individuals		Six Rivers NF	
2	Six Rivers NF	Trinity	Black Lassic (4012335)	NRIS, Feb 2017 (510470028)	1-Jul-1997	0 individuals		Six Rivers NF	
2	Six Rivers NF	Trinity	Black Lassic (4012335)	NRIS, Feb 2017 (510470028)	25-Jul-2014	96 individuals		Six Rivers 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:	-	-	-	-	-	-	-	0
Modoc:	-	-	-	-	-	-	-	0
Plumas:	-	-	-	-	-	-	-	0
San Bernardino:	-	-	-	-	-	-	-	0
Sequoia:	-	-	-	-	-	-	-	0
Shasta-Trinity:	-	-	-	-	-	-	-	0
Sierra:	-	-	-	-	-	-	-	0
Six Rivers:	2	2	-	2	-	5-Aug-2016	-	2
Stanislaus:	-	-	-	-	-	-	-	0
Tahoe:	-	-	-	-	-	-	-	0
Totals:	N/A	2	0	2	0	N/A	0	2

Demographic and Population Trends: At the type locality (EO 1) on Mount Lassic, 227 plants were observed in 2001, and less than 100 plants were observed at the last reported sighting in 2016. At the site of element occurrence two (EO 2), 200 plants were observed in 2003, and at the last reported sighting in 2016, all adults were reported as dead, with 72 seedlings having been counted (CNDDB 2017; CCH 2017; Calflora 2017).

Recorded individuals of *Lupinus constancei* at element occurrences one and two per year from 2001 to 2016 (CNDDB 2017; CCH 2017; Calflora 2017):

Year	Number of individuals at EO 1	Number of individuals at EO 2
2001	227	unknown
2002	unknown	unknown
2003	33	200
2004	81	250
2005	85	400
2006	158	430
2007	110	462
2008	179	469
2009	244	551
2010	186	358
2011	389	620
2012	428	780
2013	373	984
2014	297	807
2015	160	443
2016	<100	0 adults, 75 seedlings

Life History: *Lupinus constancei* is a perennial herb that blooms in July (CNPS 2017). Plants produce a taproot with a woody caudex, are matted and grow close to the ground, and can reach up to a foot in diameter (Imper 2016). *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 developing tissue. 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). *Lupinus constancei* is a short lived perennial that has been observed to live up to 12 years. Mature individuals growing under optimal conditions may produce up to 20 inflorescences on a single plant. Each inflorescence may produce 20 or more fruit, each with 1-4 seeds. Dehiscing fruit have been observed to project seeds up to four feet from parent plants. A seed bank study on *L. constancei* investigating viability and longevity

determined that 50% of seeds are viable after one year, 25% after two years, and an average of 22% for the proceeding three years. Successful reproductive output is substantially diminished by seed predation (up to 100% loss is some years). Predation rates are measured at 5% on plants that are protected by cages (Imper 2016).

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 nodule forming roots that house diazotrophic microbes (Stevens 2001; Sholars 2017). *Lupinus* is 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 constancei is allied with the western North American perennial cespitose lupine complex. It is said to resemble *L. lepidus* and at one time was considered a variety of this species (Tropicos 2017; Nelson and Nelson 1983). *Lupinus lepidus* 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, demonstrating unequivocally that taxa within this clade are not monophyletic and that 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). Sampling of *L. lepidus* was not increased and *L. constancei*

was not included, thus it remains undetermined if these taxa are influenced by phenomena inferred among its respective group.

Habitat: *Lupinus constancei* is endemic to serpentine barrens of the Lassics Mountain Range in Humboldt and Trinity counties (Imper 2016). It occurs on ultramafic serpentine substrate among the lower montane coniferous forest (CNDDB 2017). *Lupinus constancei* is distributed between two nearby colonies in the Lassics Mountain Range. The Red Lassic colony is on a southwest-facing slope and is supported by partial overstory shading by *Pinus jeffreyi* and by snowmelt. A majority of plants at the Mt. Lassic colony occur on moderate to steep north- and west-facing slopes with high insolation. The most vigorous plants occur on flat to moderate slopes where snowmelt is retained for greater lengths of time into the spring and summer growing season. This taxon is documented growing alongside *Pinus jeffreyi, Arctostaphylos nevadensis, Minuartia nuttallii, Pyrola picta, Holodiscus discolor, Ceanothus cuneatus, C. cordulatus, C. prostratus, Allium hoffmanii, Allium falcifolium, Calocedrus decurrens, Phacelia corymbosa*, and *Galium grayanum* (Imper 2016; CNDDB 2017).

Habitat Status or Trend: *Lupinus constancei* is a CRPR 1B.1, California endemic that is critically imperiled (G1/S1) (CNPS 2017). Both colonies were negatively affected by the Lassics Fire in 2015. It occurs in the Lassics Wilderness area and is not threatened by land use activities. It remains in a region of the Six Rivers NF that is under wilderness protection (Impers 2016).

Capacity for the Species to Disperse: Dehiscing fruit have been observed to project seed over four feet away from parent plants. The large and unwinged seeds of *L. constancei* render it unsuited to long-distance dispersal and migration to specialized habitat with similar properties to that of the serpentine barrens of Red Lassic and Mt. Lassic (Imper 2016).

Threats: Threats to *Lupinus constancei* are well documented. Pre-dispersal seed predation is shown to substantially suppress population growth. Researchers using cage exclosures found that stochastic population growth rates would be robust without pre-dispersal seed predation by rodents. Uncaged plants were shown to have an 86% seed predation rate. Predation rates decreased to 5% on caged individuals (Imper 2016). It was determined that *L. constancei* has a 68.4%-100% chance of extinction in the next 50 years without the continued use of rodent exclosures. Prolonged and continued use of exclosures results in a 0%-1.8% chance of extinction over the same period of time (Kurkjian et al. 2017).

The primary threats to this taxon are not directly linked to forest use activities. The U.S. Fish and Wildlife Service repeatedly notified Six River National Forest about giving higher priority to the recovery of *L. constancei* in an effort to avoid Federal listing. Administrative roadblocks, lack of funding and staff, and conflicting priorities were provided as reasons for inaction. Maintenance of wilderness values was cited as a justification for removal of rodent exclosures in 2012 (Imper 2016). *Lupinus constancei* is projected to diminish and become extinct in the absence of exclosures that prevent seed predators from accessing developing fruit (Kurkjian et al. 2017). Forest encroachment, climate change, and herbivory of vegetative organs are all documented threats to *L. constancei* (Imper 2016).

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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.