

Added *Lupinus paynei* to CRPR 3.1 and changed names of *L. excubitus* var. *johnstonii* and var. *medius* to varieties of *L. albifrons* in the CNPS Inventory on April 3, 2017

Rare Plant Status Review: *Lupinus paynei*, *Lupinus excubitus* var. *johnstonii*, and *Lupinus excubitus* var. *medius*

***Lupinus paynei*: proposed addition to California Rare Plant Rank 3.1 1B-1, G1Q / S1**

L. excubitus* var. *johnstonii*: proposed name change to *L. albifrons* var. *johnstonii

L. excubitus* var. *medius*: proposed name change to *L. albifrons* var. *medius

Kaitlyn Green (CNPS), Aaron E. Sims (CNPS), and Roxanne Bittman (CNDDB)

November 21, 2016

Changes made to the original document are in blue text.

Background

Lupinus paynei Davidson is a perennial shrub in the Fabaceae known only from the vicinity of Tapo Canyon in Ventura County, California. It was first described in 1918 by A. Davidson as being previously grouped within *L. longifolius*, and was subsequently subsumed within *L. excubitus* var. *hallii* by Smith (1923) and not recognized in any floristic treatments since. The confusion in identifying *L. paynei* from *L. longifolius* and *L. excubitus* var. *hallii* probably arises from the high level of morphological variation in all taxa within the *L. albifrons* complex. It was originally described as being differentiated from *L. longifolius* in being silvery-pubescent and flowering only in spring with all blooming happening simultaneously (versus markedly hirsute or pubescent and flowering continuously throughout the season in *L. longifolius*) (Davidson 1918); however, leaf pubescens is variable between *L. longifolius* and *L. paynei* (as well as *L. excubitus* var. *hallii*). The other characters used to differentiate *L. longifolius* from *L. paynei* and *L. excubitus* var. *hallii* (including long inflorescences, relatively large leaves, and differences in plant height, habit, and floral color) are also variable in all of these taxa (Huang and Friar 2011). "There is evidence, however, that these three frequently misidentified taxa are in fact distinct from one another: they each occupy distinct geographic ranges and specific edaphic zones" (Huang and Friar 2011). **However, this claim has been brought into question, as multiple lupines are known from at least one of the populations where *L. paynei* occurs (T. Sholars pers. comm. 2017).**

In order to study relationships in the *L. albifrons* species complex, Huang and Friar (2011) used sequence data from two rapidly evolving non-coding chloroplast regions. They sampled 31 taxa in the western North America perennial group and outgroups of *Lupinus*, including *L. albifrons* var. *albifrons*, *L. albifrons* var. *austromontanus*, *L. albifrons* var. *johnstonii*, *L. excubitus*, and *L. paynei*. Fresh material was collected from a wide geographic area and preserved in silica gel for genomic DNA extraction. In order to examine and compare the genetics across species as well as within species, Huang and Friar (2011) extracted and sequenced genomic DNA, conducted a phylogenetic analysis under maximum likelihood criterion, calculated haplotype networks in TCS, and ran several AMOVAs and analyses of population-level genetic diversity. Their results indicate that of the species collected, only two, *L. excubitus* and *L. paynei*, showed a clear significant difference from other species, and based on its specific edaphic or

ecological niche, *L. paynei* may have undergone ecological speciation in which selection on several genes led to divergence and reproductive isolation (Huang and Friar 2011). In addition to being genetically and geographically distinct, *L. paynei* has been described as having a sweet scent that is not at all like grape soda (as is the case with *L. excubitus*) (D. Huang 8032301 [RSA, UC]; B. O'Brien pers. comm. 2016). However, scent is not a good indicator for identifying species in the *L. albifrons* complex, and there are no morphological characters to differentiate *L. paynei* from other shrubby lupines (T. Sholars pers. comm. 2017). It has been described as being arborescent (D. Huang pers. comm. 2017; D. Taylor pers. comm. 2017), but plant height in of itself is not a strong distinguishing character.

In addition to formally recognizing *L. paynei* as being a molecularly and geographically distinct species, Huang and Friar (2011) recommend treating *L. excubitus* var. *johnstonii* (CRPR 4.3) and *L. excubitus* var. *medius* (CRPR 1B.3) as varieties of *Lupinus albifrons* instead, based on their phylogenetic placement away from distinctive *L. excubitus* samples. This follows Jepson 1936, and rejects treatment as *L. excubitus* var. *johnstonii* and *L. excubitus* var. *medius* by Sholars (1993 and 2012), and their inclusion in *L. albifrons* var. *hallii* by Isely (1998).

Lupinus paynei occurs in sandy soils in inland phases of coastal scrub, and in riparian habitats (B. O'Brien pers. comm. 2016) and valley and foothill grassland (T. Morosco, CalPhotos 2016). It is known from an approximate elevation of 220 to 420 meters (Google Inc. 2015), and primarily blooms in March and April with a potential for late blooming in May and July (although likely to also bloom in June, there are currently no reports of *Lupinus paynei* blooming in June, and we only include known blooming months in the CNPS Inventory).

Lupinus paynei is known from approximately ~~nine~~ seven occurrences in Tapo and Grimes canyons in the Simi Valley area of Ventura County. One of the ~~nine~~ seven occurrences is historical (occurrences not seen in over 20 years are considered historical by CNDDDB). Some occurrences are in areas with an unknown land ownership. The occurrences in Tapo Canyon are on privately owned land, according to Tony Morosco (pers. comm. 2016). Two collections from this area labeled as *L. excubitus* var. *hallii* are potentially *L. paynei* and need to be examined (*Davidson 2965* [RSA413599]; *White et al. 9077* [RSA692585]).

Concerns have been raised about the amount and identification of samples used of putative *L. paynei* in the study by Huang and Friar (2011). Regarding identification, there are no reliable morphological characters to distinguish *L. paynei* from other lupines in the *L. albifrons* complex, and multiple *Lupinus* spp. co-occur at the Tapo Canyon population and possibly other locations; therefore, geography alone cannot be used to identify *L. paynei* (T. Sholars pers. comm. 2017). Regarding sampling size, 4 collections of putative *L. paynei* were made from the Tapo Canyon Road population, but only 2 were sampled. For the Oak Park population, 3 samples were taken from a single collection. Overall, Huang and Friar (2011) included 6 samples of putative *L. paynei* from 5 populations. Lastly, Huang and Friar (2011) proclaim that “[a]lthough some taxonomic conclusions can be extrapolated from [their] study, overall, [the] results warn against under sampling in phylogenetic studies of recently evolved groups.

At this point *L. paynei* is critically endangered. According to Bart O'Brien (pers. comm. 2016), a number of populations sampled and studied in the past have been destroyed and are now developed as residential areas. The occurrence on Tapo Canyon Road is in a prime development site (T. Morosco pers. comm. 2016), and is estimated to be an eighth of the size that it was 10 years ago (B. O'Brien pers. comm. 2016). Much of the habitat *L. paynei* occurs in is extremely disturbed and, if not already developed, is dominated by exotic grasses that vigorously compete with *L. paynei* (B. O'Brien pers. comm. 2016). The occurrence located along Los Angeles Avenue is relatively protected from development due to the steep slope it grows on (T. Morosco pers. comm. 2016). However, all occurrences are potentially threatened by non-native plants.

Based on the available information, CNPS and CNDDDB recommend adding *Lupinus paynei* to California Rare Plant Rank **3.1 4B-4**, and changing the names of *L. excubitus* var. *johnstonii* and *L. excubitus* var. *medius* to *L. albifrons* var. *johnstonii* and *L. albifrons* var. *medius* in the CNPS Inventory. *We are adding L. paynei to CRPR 3 at this time due to a lack of identifiable characteristics to distinguish it from other Lupinus spp. in the L. albifrons complex. Lupinus paynei also hasn't been concluded to be allopatric with its related taxa. Further study is needed to determine the relationship between L. paynei and other lupines in the L. albifrons complex, particularly with regards to its distribution and morphological distinction relative to other lupines in this group. If knowledge on the distribution, taxonomic status, threats, and rarity status of L. paynei changes in the future, we will re-evaluate its status at that time.*

Recommended Actions

CNPS: Add *Lupinus paynei* to CRPR **3.1 4B-4**; change names of *L. excubitus* var. *johnstonii* and *L. excubitus* var. *medius* to *L. albifrons* var. *johnstonii* and *L. albifrons* var. *medius*

CNDDDB: Add *Lupinus paynei* to G1Q / S1; change names of *L. excubitus* var. *johnstonii* and *L. excubitus* var. *medius* to *L. albifrons* var. *johnstonii* and *L. albifrons* var. *medius*

Draft CNPS Inventory Record

Lupinus paynei Davidson

Payne's bush lupine

Fabaceae

CRPR **3.1 4B-4**

~~Shasta~~, Los Angeles, **Ventura**

Santa Susana (138C) 3411836, Oat Mountain (138D) 3411835, Piru (139A) 3411847, Moorpark (139C) 3411838, Simi (139D) 3411837

Coastal scrub, riparian scrub, valley and foothill grassland / sandy; elevation 220-420 meters.

Perennial shrub. Blooms March to April (May, July).

Move to CRPR 1B? No reliable morphological characters exist to distinguish L. paynei from other lupines in the L. albifrons complex; it has been described as being more arborescent, but this character trait has not been substantiated by data. Also not allopatric with related taxa, so geography alone cannot be used to determine its identity. Determined to be genetically distinct; more samples from additional populations would

help substantiate this determination. Further study is needed to determine the relationship between *L. paynei* and other lupines in the *L. albifrons* complex, particularly with regards to its distribution and morphological distinction. Seriously threatened by development and non-native plants. Substantial portions of populations have already been lost due to development; in serious decline. See *Bulletin of the Southern California Academy of Sciences* 17(2):58-59 (1918) for original description, and *Systematic Botany* 36(2):362-370 (2011) for taxonomic treatment.

Current CNPS Inventory Records (in part)

Lupinus excubitus Jones var. *johnstonii* C.P. Smith

Known only from the San Gabriel Mtns. Collections from KRN Co. likely misidentified.

Lupinus excubitus Jones var. *medius* (Jeps.) Munz

Possibly threatened by vehicles.

Revised CNPS Inventory Records (in part)

Lupinus albifrons Benth. var. *johnstonii* (C.P. Sm.) Jeps.

Synonym: *Lupinus excubitus* var. *johnstonii*

Known only from the San Gabriel Mtns. Collections from KRN Co. likely misidentified.

See *A Flora of California* 2(3):252 (1936) for original description, and *Systematic Botany* 36(2):362-370 (2011) for taxonomic treatment.

Lupinus albifrons Benth. var. *medius* Jeps.

Synonym: *Lupinus excubitus* var. *medius*

Possibly threatened by vehicles. See *A Flora of California* 2(3):252 (1936) for original description, and *Systematic Botany* 36(2):362-370 (2011) for taxonomic treatment.

Literature Cited

CalPhotos. 2016. CalPhotos: Plants. Regents of the University of California, Berkeley. Website <http://calphotos.berkeley.edu/flora/>

Consortium of California Herbaria. 2016. Data provided by the participants of the Consortium of California Herbaria. Regents of the University of California, Berkeley. Website <http://ucjeps.berkeley.edu/consortium/>

Davidson, A. 1918. *Lupinus paynei*. *Bulletin of the Southern California Academy of Sciences* 17(2):58-59.

Google Inc. 2015. Google Earth (Version 7.1.5.1557) [Software]. Available at <https://www.google.com/earth/>.

Huang, D. I. and E. A. Friar. 2011. Relationships in the *Lupinus albifrons* species complex (Fabaceae) based on two highly variable chloroplast regions. *Systematic Botany* 36(2):362-370.

Isely, D. 1998. *Lupinus*. Pp. 663 – 734 in *Native and naturalized Leguminosae (Fabaceae) of the United States (exclusive of Alaska and Hawaii)*. Provo: Monte L. Bean Museum Press.

Jepson, W. L. 1936. *A Flora of California*. Berkeley: Associated Students Store of the University of California.

Sholars, T. 2012. *Lupinus*. Pp. 764-778 in Baldwin, B.G., D.H. Goldman, D.J. Keil, R. Patterson, T.J. Rosatti, and D.H. Wilken (eds.), *The Jepson manual: vascular plants of California*, second edition. University of California Press, Berkeley, CA.

_____. 1993. *Lupinus*. Pp. 622-636 in Hickman, J.C. (ed.) *The Jepson manual: higher plants of California*. University of California Press. Berkeley and Los Angeles, CA.