Element Code: ?

Added to California Rare Plant Rank 1B.1 of the CNPS Inventory on October 30, 2019

Rare Plant Status Review: *Claytonia peirsonii* subsp. *californacis*
Proposed Addition to California Rare Plant Rank 1B.1, G3G4T1 / S1

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Background

Claytonia peirsonii (Munz & Johnston) T.R. Stoughton subsp. *californacis* T.R. Stoughton is a perennial herb in the Montiaceae that is only known from the San Bernardino Mountains of San Bernardino County, California. It was recently described by Stoughton et al. (2017) and is therefore not included in *The Jepson Manual* (Chambers 1993), *The Jepson Manual, Second Edition* (Miller and Chambers 2012), or *Flora of North America North of Mexico* (Miller 2004). "*Claytonia peirsonii* subsp. *californacis* was first collected during follow-up surveys in 2012 preceding a paper by Stoughton and Jolles (2013) regarding the discovery of *Claytonia lanceolata* var. *peirsonii* in the San Bernardino Mountains" (Stoughton et al. 2017). It was noticed by Tommy Stoughton that plants at Furnace Canyon in Holcomb Valley (*C. peirsonii* subsp. *californacis*) did not fully resemble plants collected earlier at Bertha Ridge (*C. peirsonii* subsp. *bernardinus*, subsp. nov.), leading him to further research and formally describe subsp. *californacis*. "The subspecific epithet, *californacis*, refers to the type locality (Furnace Canyon) for this subspecies in the San Bernardino Mountains" (Stoughton et al. 2017). See Appendix I for additional background information on this taxon along with other revisions in the *C. lanceolata* species complex.

Taxonomy

Claytonia peirsonii subsp. *californacis* is morphologically similar to *C. panamintensis* and the broad interpretation of *C. lanceolata*. It differs by its ecological setting, being associated with variable, carbonate-dominated sedimentary substrates in transmontane habitats (vs. marble, sandstone, shale/slate in *C. panamintensis*, and variable in *C. lanceolata* s.l.), betalain pigmentation on abaxial surfaces of leaves, presence of raised 2 degree veins on adaxial surfaces, and other characters. "*Claytonia peirsonii* subsp. *californacis* is probably most easily confused with other subspecies of *C. peirsonii*, particularly subsp. *peirsonii* and subsp. *yorkii* because of the shape of their cauline leaves, but these do not co-occur geographically and therefore should not be confused" (Stoughton et al. 2017). See Stoughton et al. 2017 for a taxonomic key and Table 1 in Appendix II for additional characters used to differentiate subsp. *californacis* from other taxa in the *Claytonia lanceolata* species complex in California.

Ecology

Claytonia peirsonii subsp. *californacis* occurs on north-facing, stony and talus slopes comprised of carbonate-dominated (meta)sedimentary substrates, such as limestone or marble, that are mixed with decomposing organic material from the surrounding forest. It is mostly found in openings of mixed pinyon-juniper and white fir-limber pine associations at approximately 2,300 meters in elevation (Stoughton et al. 2017). Subspecies *californacis* is known to flower from March to April based on collection records, and is presumed to bloom in May based on a voucher with flowers collected on April 29th. Associated trees include *Cercocarpus ledifolius*, *Abies concolor*, *Pinus flexilis*, *P. monophylla*, and *Juniperus osteosperma* (*Stoughton et al. 1516*, RSA0026288; CCH1 2019).

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Distribution and Abundance
Claytonia peirsonii subsp. *californacis* is known from only a single occurrence, from Furnace Canyon in Holcomb Valley within the San Bernardino Mountains of California. Its single occurrence is known from approximately 200 to 300 individuals in a single acre (*Stoughton et al. 1516*, RSA0026288; CCH1 2019), and is in San Bernardino National Forest. *Claytonia peirsonii* subsp. *californacis* co-occurs or occurs within proximity of the following six additional rare taxa: *Acanthoscyphus parishii* var. *goodmaniana*, *Astragalus lentiginosus* var. *sierrae*, *Boechera shockleyi*, *Eriogonum microthecum* var. *johnstonii*, and *E. ovalifolium* var. *vineum*, and is approximately 325 air meters from an occurrence of *Boechera parishii* (see Table 2 in Appendix II for list of rare taxa within proximity and their associated status and threats) (CNDDB 2019; CNPS 2019).

Status and Threats
There are no known direct threats to *Claytonia peirsonii* subsp. *californacis*, but its single occurrence implies that even small changes in land use or climate within its distribution could have drastic reductions in population size. In comparing documented threats to other rare plants that occur within the same area as *C. peirsonii* subsp. *californacis*, mining and off road vehicles are reoccurring threats that could possibly also impact the occurrence of *C. peirsonii* subsp. *californacis* due to proximity. Two of the taxa that occur near *C. peirsonii* subsp. *californacis* are Federally Endangered, and four of the six are designated as Sensitive by the USDA Forest Service. Since the only known occurrence of *C. peirsonii* subsp. *californacis* is wholly within the San Bernardino National Forest, it should be designated by the Forest Service as a Species of Conservation Concern.

Summary
Based on the available information, CNPS and CNDDB recommend adding *C. peirsonii* subsp. *californacis* to 1B.1 of the CNPS Inventory. Although no direct threats are currently documented, its known existence from a single occurrence of 200 to 300 plants indicates a threat rank of 0.1 is warranted, and it is potentially threatened by stochastic events. If knowledge on the distribution, threats, and rarity status of *C. peirsonii* subsp. *californacis* changes in the future, we will re-evaluate its status at that time.

Recommended Actions
CNPS: Add *Claytonia peirsonii* subsp. *californacis* to 1B.1
CNDDB: *Claytonia peirsonii* subsp. *californacis* to G3G4T1 / S1

Draft CNPS Inventory Record
Claytonia peirsonii (Munz & Johnston) T.R. Stoughton subsp. *californacis* T.R. Stoughton
Furnace spring beauty
Montiaceae
CRPR 1B.1
San Bernardino
Fawnskin (131C) 3411638
Pinyon and juniper woodland, upper montane coniferous forest / rocky, talus, carbonate, usually openings; elevation 2,300 meters.
Perennial herb. Blooms March to May

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See *Aliso* 31(1):35-42 for notes on discovery, and *Systematic Botany* 42(2):283-300 (2017) for original description.

Literature Cited

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[CNPS] Rare Plant Program, California Native Plant Society. 2019. Inventory of Rare and Endangered Plans of California (online edition, v8-03 0.39). Website http://www.rareplants.cnps.org [accessed 21 August 2019].

Chambers, K. L. 1993. *Claytonia* L. (Portulacaceae). Pp 898–900 *in* Hickman, J. C. (ed.), The Jepson manual: Higher plants of California. University of California Press, Berkeley, CA.

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Stoughton, T. R. and D. D. Jolles. 2013. Discovery of *Claytonia lanceolata* var. *peirsonii* in the San Bernardino Mountains perpetuates a history of taxonomic uncertainty. *Aliso* 31(1): 35-42. (Notes on discovery.)

Stoughton, T. R., D. D. Jolles, and R. L. O'Quinn. 2017. The western spring beauties, *Claytonia lanceolata* (Montiaceae): A review and revised taxonomy for California. *Systematic Botany* 42(2): 283-300. (Original description.)

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APPENDIX I – BACKGROUND

The following is a general summary of the revised taxonomic treatment of the *Claytonia lanceolata* species complex in California published by Stoughton et al. (2017), with emphasis on taxa that are being reviewed for addition to the *CNPS Inventory of Rare and Endangered Plants of California*.

Recent field, taxonomic, and molecular work by Stoughton and Jolles (2013) and Stoughton et al. (2017) has led to a recircumscription of *C. lanceolata* var. *peirsonii* to *C. peirsonii* subsp. *peirsonii*, along with the description of three additional subspecies, *C. peirsonii* subsp. *bernardinus*, subsp. *californacis*, and subsp. *yorkii*, which are all rare and concurrently under review for addition to the CNPS Inventory. As a result of their work, the taxonomic recognition of *Claytonia obovata* (formerly treated as a synonym of *C. lanceolata*) was also resurrected by Stoughton et al. (2017), and a new taxon, *C. serpenticola* was described; both occurring in the Klamath-Siskiyou region of northern California and southwestern Oregon. Lastly, Stoughton et al. (2017) also newly described *C. panamintensis*, a species known in California only from the Panamint Mountains of Death Valley National Park, but ranging more widely across southern Nevada. All three of these latter *Claytonia* species (*C. obovata*, *C. panamintensis*, and *C. serpenticola*) are undergoing status reviews for addition to the CNPS Inventory.

In 2013, Stoughton and Jolles reported on the discovery of new populations of *C. lanceolata* in southern California, and discussed the taxonomic uncertainties associated with the *C. lanceolata* species complex and the southern California var. *peirsonii*. Up to ten subspecific taxa have been described in the *C. lanceolata* complex (Davis 1966), with var. *peirsonii* being the only one known from southern California. Taxonomic uncertainty of var. *peirsonii* remained present for at least 25 years, evidenced in part by Chambers (1993), who considered variation in the group to be environmentally induced, and did not formerly recognize infraspecific taxa in his treatment of *Claytonia* in *The Jepson Manual*. As originally described, *C. lanceolata* var. *peirsonii* was considered to be restricted to the higher ridges of the eastern San Gabriel Mountains, distinguished by both its relative geographic isolation (at least 450 km away from other known conspecific populations) and by a primary inflorescence axis that is shortened as to make the inflorescence appear umbellate (Munz and Johnson 1923) (Stoughton and Jolles 2013). However, var. *peirsonii* was described from only two voucher specimens, indicating that variation within var. *peirsonii* was not well captured. After reviewing the entire collection of *C. lanceolata* specimens at RSA (including the holotype of var. *peirsonii*) and additional specimens at CAS/DS, HSC, UC/JEPS, and UNLV, Stoughton and Jolles (2013) found reason to believe that the southern California populations of *C. lanceolata*, including those in Kern and Inyo counties and in the Spring Mountains of Nevada, were unique and distinct from other alleged conspecific populations in northern California and adjacent northern Nevada. Their claim was also substantiated by detailed field observations of new populations discovered in the San Bernardino Mountains and all but two of the known locations in the San Gabriel Mountains, Panamint Range, and southern Sierra Nevada.

Stoughton and Jolles (2013) also noted that preliminary molecular evidence indicated that the morphological variation of *C. lanceolata* found in differing regions in California and Nevada also had a genetic basis. Four years later, Stoughton et al. (2017) conducted a Bayesian phylogenetic inference using gene sequences available on GenBank, along with new sequences generated from collections within and outside of California. Their phylogenetic comparison included more than half of the tuberous, perennial *Claytonia* species, which encompasses *C.*

lanceolata. Stoughton et al. (2017) isolated genomic DNA from leaf material of 12 *C. lanceolata* samples. "Two or more individuals per taxon were used to sample multiple examples in the *C. lanceolata* species complex (15 total samples). Nine samples of other tuberous, perennial *Claytonia* were included as outgroups with respect to *C. lanceolata* s. l. Thirty-one total samples were used for the phylogenetic analysis, including more distant outgroups from *Claytonia* and *Lewisia*" (Stoughton et al. 2017).

In order to identify substrate affinity, Stoughton et al. (2017) collected parent rock material from selected field sites of *Claytonia* in California and southern Oregon. Slope aspect, geomorphic landform, associated species, elevation, and other local site information were also recorded at field sites. Lastly, five morphological characters (stem length, cauline leaf width, cauline leaf length/width ration, and peduncle length) were measured and used in a morphometric analysis. Results of their phylogenetic analysis were inconclusive with regards to monophyly of *C. lanceolata*, mostly due to an unresolved backbone separating major lineages within a clade that included all tuberous, perennial *Claytonia* sampled in their study. Furthermore, the use of nrITS in their study may have been problematic considering the possibilities of concerted evolution and multiple copies. However, although the results of their preliminary analysis did not permit new inferences regarding relationships among tuberous *Claytonia*, this was not a specified goal of their study, and instead their phylogenetic results fully complemented their morphological analysis of Californian taxa. Ultimately, the taxonomic and molecular work by Stoughton et al. (2017), coupled with that of Stoughton and Jolles (2013), elucidated some of the complex taxonomy and relationships surrounding *C. lanceolata* s. l. in California, and distinguished new taxa from each other by habitat (with many appearing to be edaphic-endemics), betalain pigmentation, inflorescence architecture, and morphology of cauline leaves, subterranean stems, and flowers.

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APPENDIX II – TABLES AND FIGURES

Table 1: Selected characters used to differentiate taxa in the *Claytonia lanceolata* species complex in California. Taxa are listed in same order of appearance as the taxonomic key provided in Stoughton et al. (2017), with exception of the more recently described *C. crawfordii*. Light gray cells indicate duplicate entries to assist with making comparisons. (Table developed using characters from Stoughton et al. 2017 and 2018.)

Scientific name	Cauline leaves	Adaxial leaf surface	Inflorescence	Geology	Range
C. panamintensis	2-4, opposite at least proximally, 1-nerved elliptic to oblanceolate, distinctly petiolate	dark green (often at least weakly beet-red abaxially)	1-3, terminal and often also axillary, pedunculate, unibracteate, bracts 1-3 mm long	marble, sandstone, shale/slate	Panamint Mountains east to Spring Mountains of southern Nevada
C. serpenticola	2–4, alternate to subopposite, 1-nerved gen. > 5 x longer than wide, blades narrowly elliptic to lance linear	gen. greenish 1° veins at base, blades gen. similar in color on ab/adaxial surfaces	1-3, terminal and often also axillary, pedunculate, unibracteate, bract 1-2 mm long	gabbro, peridotite, serpentinite or shale	Klamath-Siskiyou, North Coast Ranges
C. lanceolata	2, opposite, 3-nerved gen. < 5 x as long as wide, ovate to lance ovate to lance linear	gen. greenish 1° veins at base, blades gen. similar in color on ab/adaxial surfaces	1(2), terminal (rarely also axillary), pedunculate, unibracteate, bracts 1-5 mm long	granite, rhyolite	Klamath-Siskiyou, central and northern Sierra Nevada
C. obovata	2(3), opposite, gen. 3-nerved with parallel veins equal in length, lateral veins converging with midrib at apex	gen. reddish 1° veins, not raised	1(2), terminal (rarely also axillary), sessile to short-pedunculate, unibracteate, bracts 1–3 mm long	graywacke, limestone, shale or gabbro, peridotite, serpentinite	Klamath-Siskiyou, North Coast Ranges

Scientific name	Cauline leaves	Adaxial leaf surface	Inflorescence	Geology	Range
C. peirsonii ssp. *bernardinus*	2-4, opposite at least proximally, 1-nerved often ≥ 6 x longer than wide, linear to lanceolate, sessile	gen reddish, sunken 1° veins; 2° veins of cauline leaves weakly if at all raised	1-3, terminal and often also axillary, sessile to short-pedunculate, unibracteate, bracts 1-3 mm long	limestone, marble	San Bernardino Mountains
C. peirsonii ssp. *yorkii*	2-4, opposite at least proximally, 1-nerved < 6 x longer than wide, gen. weakly pigmented on abaxial surfaces (reddish to purplish pigmentation often absent in stem and pedicels)	gen reddish, sunken 1° veins; 2° veins gen. noticeably raised	1-3, terminal and often also axillary, sessile to short-pedunculate, unibracteate, bract 1-3 mm long	rhyolite	southern Sierra Nevada
C. peirsonii ssp. *peirsonii*	2-4, opposite at least proximally, 1-nerved < 6 x longer than wide (gen. < 3.5 x as long as wide), variously shaped but gen. not oblanceolate, sessile	gen. reddish, sunken 1° veins (sometimes branched); 2° veins gen. noticeably raised	1-3, terminal and often also axillary, sessile to short-pedunculate, unibracteate, bracts 1-3 mm long	gneiss, granite, schist	San Gabriel Mountains
C. peirsonii ssp. *californacis*	2-4, opposite at least proximally, 1-nerved < 6 x longer than wide (gen. > 3.5 x as long as wide), gen. oblanceolate to elliptic, sessile	gen. reddish, sunken 1° veins; 2° veins gen. noticeably raised	1-3, terminal and often also axillary, sessile to short-pedunculate, unibracteate, bracts 1-3 mm long	limestone, marble	San Bernardino Mountains
C. crawfordii	narrower than *C. obovata*	2° veins gen. noticeably raised	1-3, terminal (rarely also axillary), elongate peduncle	volcanic	central Sierra Nevada

Sources:

Stoughton, T. R., D. D. Jolles, and R. L. O'Quinn. 2017. The western spring beauties, *Claytonia lanceolata* (Montiaceae): A review and revised taxonomy for California. *Systematic Botany* 42(2): 283-300.

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Table 2: CNDDB occurrences of rare plants that are known to co-occur or occur within proximity of *Claytonia peirsonii* subsp. *californacis*, displaying conservation status, Element Occurrence (EO) number, year last seen (last documented), occurrence rank, and documented threats. FE = Federally-listed Endangered, USFS Sensitive = USDA Forest Service Sensitive Species.

Scientific name	Status	EO	Year Last Seen	EO Rank	Threats
Acanthoscyphus parishii var. *goodmaniana*	1B.1 G4?T1/ S1 FE	2	2014	Good	Threat from limestone mining. Jeep road through eastern edge of population.
Astragalus lentiginosus var. *sierrae*	1B.2 G5T2 / S2 USFS Sensitive	58	1998	Unknown	None noted.
Boechera parishii	1B.2 G2 / S2 USFS Sensitive	29	197X	Unknown	Possibly threatened by mining activity.
Boechera shockleyi	2B.2 G3 / S2 USFS Sensitive	47	2013	Good	None noted.
Eriogonum microthecum var. *johnstonii*	1B.3 G5T2 / S2 USFS Sensitive	14	1998	Unknown	None noted.
Eriogonum ovalifolium var. *vineum*	1B.1 G5T1 / S1 FE	19	1998	Unknown	Area undisturbed, but ORV roads and old quarries in area.

Sources:

[CNDDB] California Natural Diversity Database. 2019. RareFind 5 [Internet]. California Department of Fish and Wildlife [Government Version, August 2019].

[CNPS] Rare Plant Program, California Native Plant Society. 2019. Inventory of Rare and Endangered Plans of California (online edition, v8-03 0.39). Website http://www.rareplants.cnps.org [accessed 21 August 2019].