Added to California Rare Plant Rank 1B.1 of the CNPS Inventory on November 4, 2019

Rare Plant Status Review: *Claytonia panamintensis*
Proposed Addition to California Rare Plant Rank 1B.1, G3G4T1 / S1
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Background

Claytonia panamintensis T.R. Stoughton is a perennial herb in the Montiaceae that is known in southeastern California from the Panamint Mountains (Inyo County) east to the Spring Mountains of southern Nevada (Clark County). 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 panamintensis* was previously identified as *C. lanceolata* (sensu Miller and Chambers 2006) or *C. lanceolata* var. peirsonii (sensu Stoughton and Jolles 2013 [now known as *C. peirsonii*]) in the Panamint Mountains. Its distribution, habitat, DNA, and morphology identified by Stoughton et al. (2017) indicate it as a distinct species worthy of recognition. The specific epithet, *panamintensis*, refers to its type locality in the Panamint Mountains. See Appendix I for additional background information on this taxon along with other revisions in the *C. lanceolata* species complex.

Taxonomy

Claytonia panamintensis is superficially similar to the broad interpretation of *C. lanceolata* (sensu Miller and Chambers 2006) and is distinctly petiolate, not to be confused with sessile-leaved *C. lanceolata* s.s. It differs from the entire C. peirsonii species complex in having nodding flower buds (vs. spreading to erect buds in C. peirsonii) and an elongate peduncle. It also differs from C. lanceolata s.l. in California by its ecological setting (associated with transmontane habitats and a mixture of variable sedimentary and metasedimentary substrates), shape, arrangement, and venation of cauline leaves, longer stems, and a racemose inflorescence that retains an elongate peduncle with little to no internodal elongation among pedicels by time of fruiting. See Stoughton et al. 2017 for a taxonomic key and Table 1 in Appendix II for additional characters used to differentiate *C. panamintensis* from other taxa in the *Claytonia lanceolata* species complex in California.

Ecology

Claytonia panamintensis occurs on north-facing, stony and talus slopes comprised primarily of (meta)sedimentary substrates such as marble, shale/slate, and sandstone, that is mixed with decomposing organic material. It's most often in openings of *Pinus-Juniperus* and *Quercus* woodland habitats (Stoughton et al. 2017) at an approximate elevation of 1,825 to 1,930 meters (CCH1 2019; Google LLC 2019; Stoughton et al. 2017). Claytonia panamintensis is known to flower from March to May based on collection records (CCH1 2019). Associated trees include *Pinus monophylla* and *Juniperus osteosperma* (*Stoughton 1711*; CCH1 2019; CNDDB 2019).

Distribution and Abundance

Claytonia panamintensis is currently only known from a single occurrence in California along with three populations in the Spring Mountains of southern Nevada, where it is currently also considered rare. The single occurrence in California is in protected areas of limestone talus below steep, north-facing cliffs in Upper Johnson Canyon of the Panamint Mountains in Death

Valley National Park (CCH1 2019; Stoughton et al. 2017). "*Claytonia panamintensis* should be sought out in additional areas throughout southeastern California, particularly in (meta)sedimentary habitats of the *Pinus-Juniperus* and *Quercus* belts in mountainous areas adjacent to the Panamint Mountains, and east toward the Spring Mountains in southern Nevada. Collections held at CAS/DS, NSMC, and UNLV from the Bristol Range and Mormon Mountains in Lincoln Co., Nevada, approach *C. panamintensis* in gross morphology but may represent a distinct taxon and therefore are not included as representative here. More field and molecular work are needed to address these outstanding questions." (Stoughton et al. 2017).

Status and Threats
There are no known direct threats to *C. panamintensis*. Its occurrence in protected areas below steep cliffs along with being in Death Valley National Park should afford it with protections. Nevertheless, since it is only known from a single occurrence in California at this time, we recommend a Threat Rank of 0.1 based on threats from climate change and potential stochastic events. The occurrence of *C. panamintensis* is within a documented occurrence of *Perityle villosa* (1B.3, BLM Sensitive; EO 4) from 2001, and about 500 meters east of a historical occurrence of *Cuniculotinus gramineus* (2B.3; EO 6) from 1977; both of these other rare plant records have an unknown occurrence rank and lack threat information in the CNDDB (2019) and CNPS Inventory (2019).

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

Recommended Actions
CNPS: Add *Claytonia panamintensis* to 1B.1
CNDDB: Add *Claytonia panamintensis* to G3G4T1 / S1

Draft CNPS Inventory Record
Claytonia panamintensis T.R. Stoughton
Panamint spring beauty
Montiaceae
CRPR 1B.1
Inyo
Panamint (302D) 3611711
Pinyon and juniper woodland (openings) / rocky, talus slopes, carbonate; elevation 1,825 to 1,930 meters.
Perennial herb. Blooms March to May
See *Aliso* 31(1):35-42 for notes on discovery, and *Systematic Botany* 42(2):283-300 (2017) for original description.

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

Sent to: ES/D, D. Jolles on 09/06/2019

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[CCH1] Consortium of California Herbaria 1. 2019. Data provided by the participants of the Consortium of California Herbaria. Regents of the University of California, Berkeley. Website http://ucjeps.berkeley.edu/consortium/ [accessed 4 September 2019].

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Miller, J. M. and K. L. Chambers. 2006. Systematics of *Claytonia* (Portulacaceae). *Systematic Botany Monographs* 78: 1–236. (Not seen.)

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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.

Literature Cited

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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 the 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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