Added to California Rare Plant Rank 1B.2 of the CNPS Inventory on 21 July 2020

Rare Plant Status Review: *Nemacladus inyoensis*
Proposed Addition to California Rare Plant Rank 1B.2, G2 / S2
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Background and Taxonomy

Nemacladus inyoensis Morin & T.J.Ayers is an annual herb in the Campanulaceae that is nearly endemic to the Inyo and White Mountains of Inyo County, California. It was recently described by Morin and Ayers (2020) and is therefore not yet included in the *Jepson eFlora* (Morin 2012). The *Flora of North America North of Mexico* (*FNA*), Volume 18 treatment for Campanulaceae is forthcoming, and the preparation and research for the *FNA* treatment is what prompted this species to be described. In the course of developing the *FNA* treatment for *Nemacladus* and describing *N. inyoensis*, Morin and Ayers (2020) reviewed more than 3500 herbarium specimens from 36 herbaria and visited more than 100 populations of *Nemacladus* in the field. Since so many characters in *Nemacladus* are lost or difficult to see on herbarium specimens, a concerted effort to see as many populations of *Nemacladus* in the field as possible began in 1993. Plants were photographed in the field and laboratory, and preserved for morphological character review and molecular sequencing. Consistent differences of the morphological characters were revealed in architecture, leaf size and shape, bract shape and aspect, pedicel shape, flower orientation, sepal shape and aspect, corolla size, shape and coloration, filament and anther coloration, and capsule shape. Additionally, in most cases morphological traits correlated well with geographical distribution and results of unpublished preliminary molecular analyses by Neff and Ayers (Morin and Ayers 2020).

Nemacladus inyoensis was first discovered, photographed, and collected by Steve Matson in the Inyo Mountains in 2010. Matson sent his collection and photos to N. Morin for determination, but the single collection was not enough to determine whether it was an odd *N. sigmoideus* or a new species. Later, three large populations were found by Matson, A. Schusteff, and M. Purdy in May and June, 2019, and provided enough material to confirm it as a new species. The epithet, *inyoensis*, is indicative of this species' original discovery in the Inyo Mountains of eastern California (Morin and Ayers 2020). We propose the common name 'Badger Flat threadplant' as used in iNaturalist (2020) in reference to the location it was first discovered, on a "Ridge just south of Badger Flat" in the Inyo Mountains (*Matson 2539*, UC).

"*Nemacladus inyoensis* differs from other *Nemacladus* species in its combination of bracts, hypanthium, and sepals having a very dark purplish-green color, corolla being cup-shaped, white to cream-colored with maroon stripe from throat to base on abaxial 3 lobes, and small, 2.1–2.4 mm; transparent cells being thin, cylindrical, attached to oblique appendage on filaments; and capsule dark brownish greenish purple, large, base flat to obtuse." (Morin and Ayers 2020). It is similar to *N. eastwoodiae*, another, more widespread newly described species by Morin and Ayers (2020) that occurs primarily in the Mojave Desert and Owens Valley of California and Nevada, and *N. gracilis*, a species that was described by Alice Eastwood in 1903 and circumscribed by Robbins (1958) as being limited to the Inner South Coast Range from Merced County to Kern County, and in the foothills of the Tehachapi Mountains. *Nemacladus inyoensis* is differentiated from both *N. eastwoodiae* and *N. gracilis* in having sepals in fruit that are erect

to spreading from base, broadly deltate, with cylindrical transparent cells on filaments (vs. sepals in fruit flared from base or clasping capsule, oblong-deltate or narrowly deltate, and attenuate transparent cells on filaments in *N. eastwoodiae* and *N. gracilis*). It is further differentiated from these two species in having a dark purplish green hypanthium and capsule with a flat base and acute tip (vs. hypanthium green, capsule straw-colored, with an acute base and rounded tip). *Nemacladus inyoensis* is also similar to *N. rigidus* in having dark stem, leaves, bracts, hypanthium, sepals, and mature capsule, and broadly deltate sepals (see "Key to Species of *Nemacladus*" in Morin and Ayers 2020 for distinguishing characters between *N. inyoensis* and other taxa in the genus).

Ecology

Nemacladus inyoensis occurs in limestone, sandstone, and granitic rubble and washes within pinyon juniper woodland and upper Mojavean desert scrub, at an approximate elevation of 1735 to 2635 meters (Google LLC 2020) (from 1680 to 2600 meters according to Morin and Ayers 2020). It is known to flower in May to June (iNaturalist 2020; Morin and Ayers 2020). Documented plants that co-occur with *N. inyoensis* include *Artemisia nova, A. tridentata, Chamaebatiaria millefolium, Cordylanthus kingii* subsp. *helleri, Cryptantha gracilis, Diplacus parryi, Eriastrum wilcoxii, Eriogonum fasciculatum* var. *polifolium, E. inflatum, E. nidularium, E. rupinum, Festuca octoflora, Juniperus osteosperma, Lupinus brevicaulis, L. flavoculatus, Oreocarya hoffmannii, Penstemon* sp., *Pinus jeffreyi, P. monophylla, Phlox stansburyi*, and *Stipa speciosa* (Morin and Ayers 2020: *Matson 2539*, UC; *Morefield 5896, 5897*, and *5902*, UC).

Distribution and Abundance

Nemacladus inyoensis is known from 12 occurrences with all but one occurrence being from Inyo County (a single occurrences is known from adjacent Mono County). All of its occurrences are recent, with the majority of its occurrences having been documented in May and June of 2019; the oldest occurrence (record 3) is from June 20, 2010 and represents the date this species was first discovered. Three occurrences have documentation of population size and are all considered to have large numbers of individuals, indicating the species as "locally abundant" (record 4), "abundant on flats" (record 6), and as a "large population" (record 10), with no indication of small population sizes noted (iNaturalist 2020; Morin and Ayers 2020).

All occurrences of *N. inyoensis* are on public lands, with the majority (9) occurring in Inyo National Forest, two in BLM, and one in Death Valley National Park. The record from Death Valley represents a range extension of approximately 64 air km to the southeast of the nearest occurrences, and has been verified as correctly identified by N. Morin (pers. comm. 2020). Due to its diminutive size and the remoteness of the areas it occurs, it is likely that additional occurrences of *N. inyoensis* will be discovered. However, what's interesting is that 2010 is the earliest known collection of this species and there are no known voucher records of it that were formerly misidentified and labeled as other similar taxa. "It isn't like it has been out there and collected but not recognized. So, something happened in these last couple of years that awakened the seed bank that must be pretty widespread in those mountains. Now that new seed has been set we may see these populations persist for a while and maybe we will find more." (N. Morin pers. comm. 2020).

Status and Threats

Nemacladus inyoensis is threatened by vehicles and mining, and is potentially threatened by road construction. Record 10 is considered a "large population" of *N. inyoensis* (M. Jesus, iNaturalist 2020), and lies directly in the proposed Minimum Construction Alternative (MCA) route of the Perdito Exploration Project at Conglomerate Mesa in the southern Inyo Mountains of Inyo County (BLM 2017; Cedar Creek Associates, Inc. 2017, Map 1). The Perdito Exploration Project is located on existing un-patented lode mining claims on public land administered by the BLM Ridgecrest Field Office and was approved by the BLM in 2018 (BLM 2018), prior to the formal description of *N. inyoensis*. The project includes a drilling rig to access seven specific locations; two of the seven locations are within the Cerro Gordo-Conglomerate Mesa Area of Critical Environmental Concern, and all seven sites are within California Desert National Conservation Lands (BLM 2018). For the mining operation, "Silver Standard U.S. Holdings Inc. intends to construct seven drill pads and subsequently drill seven diamond core exploration holes to a maximum depth of 1,000-feet deep. To do so, the company wants to build an exploration road on previously disturbed and reclaimed lands. This would allow vehicular access to the drilling site. A BLM-managed dirt road is currently used to access the project area from Saline Valley Road." (BLM 2020). Currently the project alternative of the use of helicopters to access the seven drilling sites has been approved (BLM 2018), and while the development of the exploration road has not been approved, an application to BLM for road access drill permit was planned to be submitted in May 2020 (K2GOLD 2020). Nevertheless, even if the exploration road is not approved, increased traffic on the existing road will do damage to the population [of *N. inyoensis*] (M. Jesus pers. comm. 2020).

Other rare plants that occur along the MCA and in the direct vicinity of record 10 of *N. inyoensis* include *Allium atrorubens* var. *cristatum* (CRPR 4.3), *Hecastocleis shockleyi* (CRPR 3), *Oenothera cespitosa* subsp. *crinita* (CRPR 4.2), *Perityle inyoensis* (CRPR 1B.2), and *Sclerocactus polyancistrus* (CRPR 4.2) (CNPS 2020; Cedar Creek Associates, Inc. 2016, Map 2 and 2017, Map 1).

Summary

Based on the available information, CNPS and CNDDB recommend adding *Nemacladus inyoensis* to California Rare Plant Rank 1B.2 of the CNPS Inventory. Although only one of its 12 occurrences are currently indicated to be threatened, we recommend a threat rank of 0.2 at this time. The threatened occurrence is noted to be significant in size, and population count / estimates have only been given to three of 12 (25%) known occurrences, so we are unsure what the majority of the population sizes are of this species. We are also uncertain how much of record 10 will be impacted by associated road use for gold mining operations and the future viability of this occurrence. If knowledge on the distribution, threats, and rarity status of *Nemacladus inyoensis* changes in the future, we will re-evaluate its status at that time.

Recommended Actions

CNPS: Add *Nemacladus inyoensis* to CRPR 1B.2
CNDDB: Add *Nemacladus inyoensis* to G2 / S2

Draft CNPS Inventory Record

Nemacladus inyoensis Morin & T.J.Ayers
Badger Flat threadplant
Campanulaceae

CRPR 1B.2
Inyo, Mono
Wildrose Peak (325D) 3611731, Santa Rosa Flat (327B) 3611746, Nelson Range (349C) 3611756, Mazourka Peak (372A) 3611881, Waucoba Spring (391C) 3711718, Cowhorn Valley (392A) 3711821, Uhlmeyer Spring (392B) 3711822, Waucoba Mtn. (392D) 3711811, Westgard Pass (412C) 3711832, Deep Springs Lake (412D) 3711831, Chalfant Valley (432D) 3711853
Pinyon and juniper woodland, Mojavean desert scrub / carbonate, standstone, and granitic; gravelly, rocky, scree, flats, and washes; elevation 1735 to 2635 meters.
Annual herb. Blooms May to June.
Discovered in 2010 by Steve Matson. Threatened by vehicles and mining; potentially threatened by road construction. See *Madroño* 67(1): 35-60 (2020) for original description.

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Personal Communications

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