Otay tarplant
(*Deinandra conjugens*)

5-Year Review:
Summary and Evaluation

Photo by Anna Leavitt, RECON Environmental, Inc.

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Carlsbad Fish and Wildlife Office
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ACKNOWLEDGEMENTS

This 5-year review is based on a status assessment prepared by Diane Cordero during her 2023 Science in the Service Fellow at the Carlsbad Fish and Wildlife Office. To complete her assessment, Diane conducted a literature review, updated occurrence data, coordinated with Service and external partners, assessed current threats to the species, and identified priority research and conservation tasks.

5-YEAR REVIEW

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GENERAL INFORMATION

Species: Otay tarplant (*Deinandra conjugens*), a plant subspecies
Date listed under the Endangered Species Act: October 13, 1998
Federal Register citation: Service 1998 (63 FR 54938)
Classification: Threatened
Recovery Plan: Final, December 7, 2004. Recovery Plan for *Deinandra conjugens* (Otay tarplant).
Recovery Priority Number: 8C
Critical Habitat Designation: December 10, 2002, (67 FR 76030).

BACKGROUND

Under the Endangered Species Act of 1973, as amended (Act; 16 U.S.C. 1531 et seq.), the U.S. Fish and Wildlife Service (Service), referred to as "we" in this document, maintain lists of endangered and threatened wildlife and plant species (referred to as the List) in the Code of Federal Regulations (CFR) at 50 CFR 17.11 (for wildlife) and 17.12 (for plants). Section 4(c)(2)(A) of the Act requires us to review each listed species' status at least once every 5 years.

Most recent status review: Service. 2009. Otay tarplant (*Deinandra* (*=Hemizonia*) *conjugens*) 5-Year Review. Prepared by the Carlsbad Fish and Wildlife Office, Carlsbad, California. 33 pp. + appendices.

A recovery plan was completed for *Deinandra conjugens* on December 7, 2004. The Service initiated a previous status review for *D. conjugens* on March 22, 2006 (71 FR 14538). The review was finalized on June 30, 2009, and recommended no change in the listing status for this species; however, the recovery priority number (RPN) was changed from 5 to 8C at that time due to considerable conservation protecting much of the habitat from development (USFWS 2009, pp. 27– 28). This current review is based on the previous review.

Federal Register notice announcing this status review: On May 20, 2021, we published a *Federal Register* notice announcing initiation of the 5-year review of this species, and the opening of a 60-day period to receive information (USFWS 2021, pp. 27462–27464). No comments for *Deinandra conjugens* were received.

Species Overview and Habitat: *Deinandra conjugens* (Otay tarplant) is an annual herbaceous plant in the sunflower family (Asteraceae) (Baldwin 2012, pp. 29, 298). Individual plants range in height from 1 to 5 decimeters (4-19 inches (in)) with lobed leaves covered with coarse hairs (Baldwin 2012, p. 298). The yellow flower heads consist of 7 to 10 ray flowers (3-6 millimeters (less than 1 in)) and 13 to 21 disk flowers (Baldwin 2012, p. 298). It can be distinguished from other members of its genus by its phyllaries, including its striated (ridged) phyllary body, red to dark purple anthers (part of flower that produced pollen), and by the number of disk and ray

flowers (Baldwin 2012, p. 298). As characteristic of most other tarplants, *D. conjugens* is self-sterile with a self-incompatible pollination system; that is, it has one self-incompatibility gene and thus cannot be fertilized with its own pollen or with pollen from another plant that shares a self-incompatibility allele. Thus, an individual will only produce viable seeds when cross-pollinated by an individual that does not share either allele (USFWS 2004, p. 5). The flowering period for *D. conjugens* is generally between May and June (California Native Plant Society (CNPS) 2023) but can extend into early fall (Bauder et al. 2002, p. 5). *Deinandra conjugens* has a discontinuous distribution in southwestern San Diego County, California in the United States and Baja California, Mexico. It is generally found on clay soils or clay subsoils associated with grassland, coastal sage scrub, or maritime succulent scrub habitats.

ASSESSMENT

This 5-year review was conducted by the Service's Carlsbad Fish and Wildlife Office. Data for this review were solicited from the public and interested parties through a *Federal Register* notice announcing this review on May 20, 2021 (USFWS 2021, pp. 27462–27464). We did not receive any information as a result of this notice. We used information in the 1998 listing rule, 2009 5-year review, available literature, reports, and information in our files. We also contacted the San Diego Management and Monitoring Program (SDMMP); Otay Water District; RECON Environmental, Inc.; California Department of Fish and Wildlife (CDFW); and species experts, to request any data or information we should consider in our review. This review relies heavily on the California Natural Diversity Database (CNDDB) that organizes plant records into unique element occurrences (EO; CNDDB 2023). The EO structure is used throughout this review consistent with the 2009 5-year review. Our understanding of the status of occurrences in Mexico is primarily informed by surveys led by Dr. Sula Vanderplank, San Diego Natural History Museum.

SUMMARY OF NEW INFORMATION SINCE 2009

Conservation Planning

The San Diego Multiple Species Conservation Program (MSCP), a regional habitat conservation plan (HCP), was approved in 1997 with a Planning Area that includes 11 local jurisdictions, including the City of San Diego, City of Chula Vista, and portions of the unincorporated County of San Diego. Each jurisdiction prepares and implements their own Subarea Plan consistent with the goals and objectives of the subregional plan. Framework management plans also provide guidance on monitoring and management responsibilities for the preserves within the various Subarea Plans. The San Diego Management and Monitoring Program (SDMMP) was created in 2008 to provide regional coordination of management and monitoring on conserved lands within San Diego County. The SDMMP prepared a Management Strategic Plan that identifies specific management goals and objectives for *Deinandra conjugens* (SDMMP 2021, Table 4.4-1, pp. 205–207), which is in line with the 2004 recovery plan (USFWS 2004, entire). At the time of the 2021 report, the majority of objectives were in process or completed with the exception of developing a permanent seed bank for research and management. SDMMP also conducts regular monitoring at occurrences on preserved lands, which is used to guide decisions by land managers and was also used to inform this 5-year review.

Habitat

SDMMP has developed, funded, and implemented objectives to address gaps in our understanding of *Deinandra conjugens* habitat that can be used to improve management and the recovery strategy (SDMMP 2021, Table 4.4-1). In 2018 the SDMMP funded a study focused on identifying geographic areas to support the resilience of edaphic endemic species. The study determined that *D. conjugens* occurred on nutrient-poor soils that had unique physical and chemical soil properties (CBI 2018, pp. i, 9). There was also a positive relationship between *D. conjugens* and clay, sodium, magnesium, and low-fertility soils. In addition, in 2016 a study was conducted to determine potential pollinators and assess visitation rates. Beetles in the family Melyridae were the most common visitors, followed by bees and flies (Marschalek and Deutschman 2016, entire). Both pollinators that occur in high numbers and those that move quickly between flowers were hypothesized to be important for pollination and gene flow in *D. conjugens.*

Genetics

At the time of listing, the genetic population structure of *Deinandra conjugens* was unknown. Since the last 5-year review, SDMMP funded a study to evaluate genetic diversity and population structure (USGS 2018, entire). Samples for genetic analysis were collected from 220 individuals across 16 extant occurrences in 2016 and 2017 (USGS 2018, p. 27). Inbreeding and differentiation between occurrences was low and there was no evidence of distinct genetic clusters or isolation by distance. Additionally, *D. conjugens* had a high rate of gene flow and low risk of outbreeding depression and is assumed to function as one, interconnected population (USGS 2018, pp. 27–31). However, development and habitat fragmentation are relatively recent events that may result in genetic differentiation or decreased genetic variation in the future. Based on this information, SDMMP developed genetic management strategies to maintain gene flow and connectivity including restoring habitat for pollinators and seed dispersers, augmenting the size of occurrences, and managing threats (SDMMP 2021, p. 225). Although not explicitly evaluated, high reported gene flow in *D. conjugens* is likely to maintain allele diversity for self-incompatibility, and along with a diverse, long-lived seedbank, likely reduce concerns regarding sporophytic self-incompatibility (Fraga 2023, pers. comm.).

Distribution

Deinandra conjugens is an endemic plant found in southwestern San Diego County, California in the United States and northern Baja California, Mexico. At the time of listing, we defined its distribution as 25 historical and 22 extant locations near Otay Mesa, as well as 2 locations in Baja California, Mexico (Roberts 1997, p. 1; USFWS 1998, p. 54939). Since listing, the known range of *D. conjugens* in the United States now extends to the north and northwest in San Diego County, based on herbarium records at the San Diego Natural History Museum and additional survey efforts (USFWS 2002, p. 76032). To update *Deinandra conjugens* occurrence status, we

reviewed Element Occurrence (EO) data from the California Natural Diversity Database[1] (CNDDB) and monitoring data from the SDMMP.

For this review, we used the following definitions of occurrence status:

1. We considered an occurrence extant if *Deinandra conjugens* had been observed at the occurrence within the last 10 years and the habitat is still intact.

2. We considered an occurrence presumed extant if *Deinandra conjugens* had not been observed for over 10 years, but suitable habitat is still intact; and we are not aware of other threats that would cause the species to be extirpated.

3. We considered an occurrence possibly extirpated if *Deinandra conjugens* had not been observed for over 10 years and the habitat was degraded or partially developed such that large portions may no longer be suitable to support the species.

4. We considered an occurrence extirpated if the habitat was destroyed and could no longer support the species.

For this 5-year review, we identified the current spatial distribution of *Deinandra conjugens* in San Diego County to include 47 geographic locations representing 36 extant or presumed extant occurrences (Table 1; Figure 1). Another 17 locations of *D. conjugens* have been recorded from various survey efforts in San Diego County since the time of listing and our last 5-year review in 2009 (EOs 44-60; CNDDB 2023, entire). In total, 12 of the 17 newly identified occurrences (EO 44, 45, 46, 48, 49, 50, 51, 53, 55, 57, 59, and 60) were recorded prior to the last 5-year review but were not reported, likely because the reports or survey data had not been circulated or received (marked by a * for 2009 Status in Appendix A). The new locations likely represent previously undetected occurrences and are not believed to be the result of recent colonization events (USFWS 2009, p. 15). Based on these new occurrences, the known distribution of *D. conjugens* has incrementally expanded to the northwest, west, and east, as well as increasing the number of occurrences within the historical range. Eight localities or occurrences were extirpated or possibly extirpated at listing or the time of the last 5-year review largely due to urbanization or OHV use; and no new extirpations were recorded (Appendix A). EOs 6, 7, 24, and 47 were identified as extirpated or possibly extirpated in our 2009 5-year review (USFWS 2009, pp. 38–55); and are now identified as presumed extant based on a visual assessment of available suitable habitat using 2022 aerial imagery. However, field surveys are recommended to confirm the status.

[1] The California Natural Diversity Database (CNDDB) is an inventory of the status and locations of rare plants and animals in California. The CNDDB assigns “Element Occurrence” (EO) numbers to unique locations of rare taxa. In this document, we use the term “occurrence” to refer to EOs delineated by the CNDDB, or locations not in the CNDDB that are greater than 0.25 miles (0.40 kilometers) apart.

Table 1. Summary of occurrence status for *Deinandra conjugens* in 1998, 2009, and 2023, based on the occurrences evaluated in this review (Appendix A).[2]

Occurrence status	Number of occurrences in 1998	Number of occurrences in 2009	Number of occurrences in 2023
Extant	17	20	30
Presumed extant	-	-	6
Possibly extirpated	-	2	1
Extirpated[3]	6	9 (3)	7(0)
Unknown	-	-	3
Occurrence total	**23**	**24**	**47**

San Diego County Subgroups in the United States

Although research has shown one genetic cluster for the entire U.S. distribution of *Deinandra conjugens*, designating subgroups allows for the monitoring of connectivity and habitat throughout the range (SDMMP 2021, p. 230). We identified nine subgroups (S1-S9) based on the presence of suitable habitat and potential for movement of pollinators between occurrences. Subgroups S1-S7 are based on the population subgroups determined in the 2021 MSP Framework Rare Plant Management Plan that focused on identifying areas for seed collection and restoration (SDMMP 2021, p. 233). We modified these subgroups to account for new records and records on private land that were not incorporated in the plan. The locality for the nine population subgroups as well as their corresponding EOs are summarized in Table 2.

Table 2. Summary of *Deinandra conjugens* population subgroups in San Diego County, S1–S9.

Subgroup	Location	EOs
S-1	North Sweetwater Reservoir	3, 24, 35, 38, 47
S-2	Paradise Hills	52, 53, 60
S-3	South Sweetwater Reservoir and San Miguel/ Proctor Valley	10, 19, 34, 46, 51, 57
S-4	Chula Vista	1, 9, 48, 49, 50
S-5	Otay Mesa - West	6, 43, 44, 45
S-6	Otay Valley	7, 12, 13, 15, 16, 18, 37, 40, 41, 42, 55, 56, 59
S-7	Rancho Jamul	54
S-8	Otay Mesa Border Crossing	11, 58
S-9	Otay Mesa - East	5, 30

[2] *Three of 25 localities were considered extirpated at listing (USFWS 1998, p. 54939) that do not cross walk exactly to the element occurrences (EOs) evaluated in this review. Similarly, 34 occurrences were considered extant in 2009 5-year review, including 8 new occurrences and 9 extirpations.*

[3] *Total number of extirpated occurrences (number of new extirpations since the previous 5-year Review).*

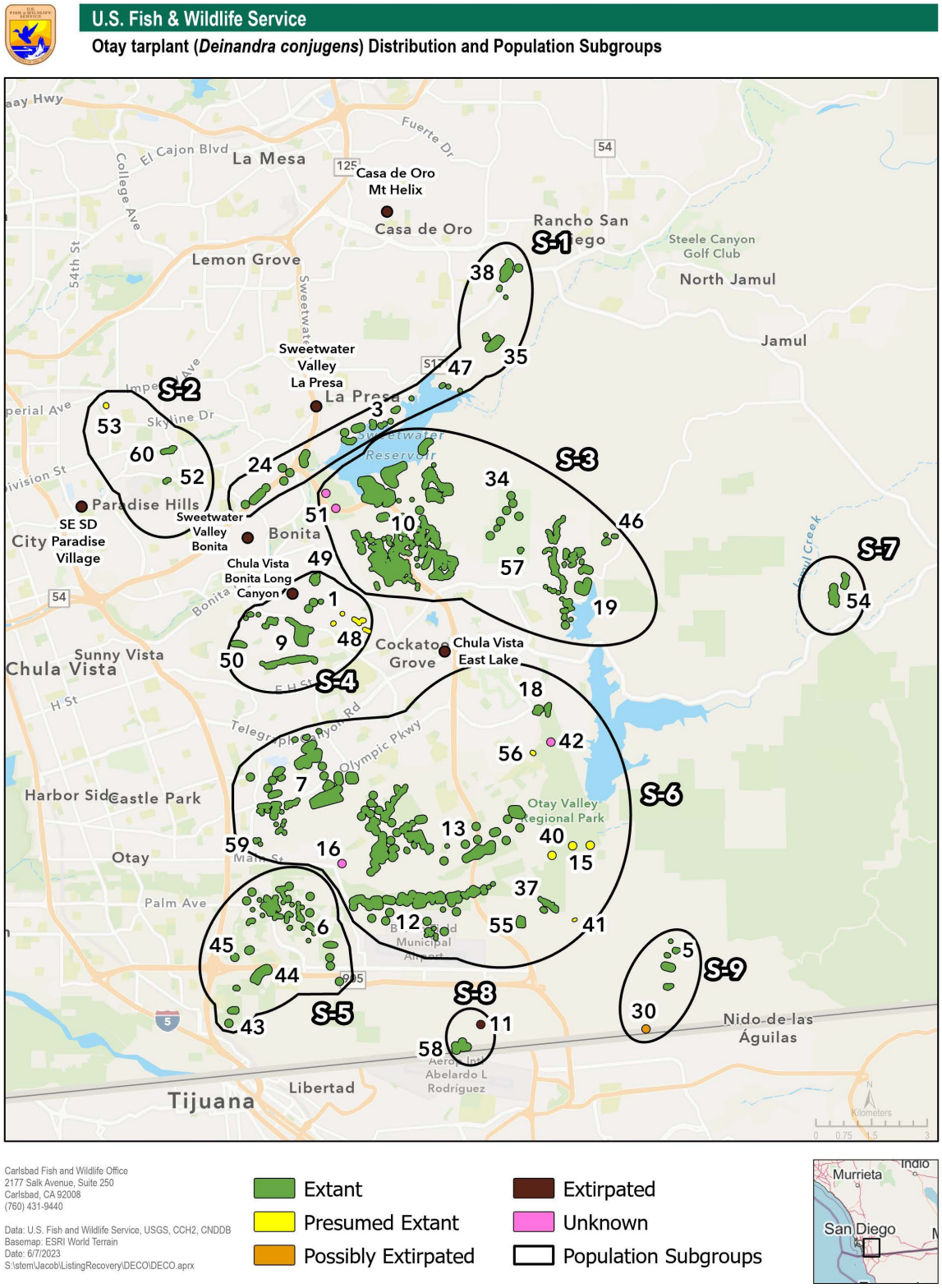

Figure 1. *Deinandra conjugens* distribution and population subgroups within San Diego County.

Subgroup 1 (S-1)

S-1 occurs north of Sweetwater Reservoir, extending from the southern portion of Bay Terraces to Jamacha Junction (EOs 3, 24, 35, 38, and 47; Figure 1; Appendix A). EO 47, northeast of Sweetwater Reservoir, was not known at listing and was considered possibly extirpated at the time of the last 5-year review, though it was not previously assigned an EO. All of the occurrences in S-1 occur within the MSCP County Subregional Plan and are conserved or partially conserved. Occurrences 3 and 47 occur within the Sweetwater Reservoir Open Space and are currently managed by the Sweetwater Authority. EO 24 occurs within the City of San Diego and County of San Diego Subarea Plans. Occurrences 35 and 38 occur within the County of San Diego Subarea Plan on the San Diego National Wildlife Refuge (SDNWR) and are monitored by SDMMP. Two historical occurrences occurred north of S-1 that are now extirpated. *Deinandra conjugens* has not been observed in La Presa since 1937 and Casa de Oro/Mount Helix since 2003. The primary threats in this area include urbanization (on non-conserved lands), nonnative plants, fuel modification, and climate change, discussed further in the threat section below (see Appendix A).

Subgroup 2 (S-2)

S-2 occurs in City of San Diego in the vicinity of Paradise Hills and includes three occurrences (EOs 52, 53, and 60) that were not known at listing and expand the species distribution to the northwest (CDFW 2023, entire; Figure 1; Appendix A). An occurrence was described at Paradise Valley in the last review that may be attributed to one of these occurrences, but we lack the location information to verify. The S-2 occurrences occur with the City of San Diego MSCP Subarea plan, are fully conserved, and are actively monitored and managed. A historical observation occurred at Paradise Village, just outside of S-2, and was last observed in 1936. This historical occurrence was considered extirpated due to urban development at the time of listing. Current threats include nonnative plants and climate change (Appendix A).

Subgroup 3 (S-3)

S-3 occurs south of Sweetwater Reservoir, including San Miguel Ranch, Mother Miguel, Proctor Valley, and Rolling Hills Ranch (Figure 1). S-3 (EOs 10, 19, 34, 46, 51, and 57) includes three occurrences that were not known at the time of the last 5-year review, two of which are new extant occurrences (EO 46, 57; USFWS 2009, Appendix A). S-3 occurrences are covered by various conservation mechanisms, including the City of San Diego Subarea Plan, City of Chula Vista Subarea Plan, and County of San Diego Subarea Plan; and 45 percent or greater of the occupied habitat at each occurrence is estimated to be conserved. EO 34 and 57 occur within the Otay Water District's San Miguel Habitat Management Area where they are actively monitored and maintained (Merkel 2023, pp. 16–18, 49). All S-3 occurrences are extant, except for EO 51, which has an unknown status due to the lack of survey data since the 1990s though the habitat area appears to be intact. Current threats to this area include urbanization in areas not conserved, nonnative plants, fuel modification, OHV, and climate change (Appendix A).

Subgroup 4 (S-4)

S-4 includes Rice Canyon and Bonita Long Canyon in northern Chula Vista (EOs 1, 9, 48, 49, and 50; Figure 1). S-4 includes three new, extant occurrences that were not known at listing and

were not included in last 5-year review despite being recorded in 2003 (48, 49, 50; USFWS 2009, Appendix A). A historical observation was observed northwest of EO 1 near Long Canyon and was last observed in 1993 and has been considered extirpated due to urbanization since listing. All occurrences in this subgroup are currently extant, except for EO 48, which is presumed extant and has not been revisited since the initial sighting in 2003. All occurrences in S-4 occur within the City of Chula Vista Subarea Plan; portions of EO 1 and EO 9 also occur in the County of San Diego Subarea Plan. Four of the five occurrences are mostly to completely conserved, while EO 1 is partially conserved. Current threats to this area include urbanization in areas not conserved, nonnative plants, fuel modification, OHV, and climate change (Appendix A).

Subgroup 5 (S-5)

S-5 occurs south of Otay Valley, east of the I-805 freeway, and west of Otay Valley Road; and contains two new occurrences that were not known at the time of the last 5-year review (EOs 6, 43, 44, and 45; Figure 1; USFWS 2009, Appendix A). All occurrences in this subgroup are considered extant. To date, the highest abundance of *Deinandra conjugens* was recorded at an occurrence in EO 6 in 2019, where an estimated 3.8 million plants were observed (CNDDB 2023, p. 5). All occurrences within S-5 occur within the City of San Diego Subarea Plan and portions of EO 6 also occur within the City of Chula Vista Subarea Plan. Current threats to this area include urbanization in areas not conserved, nonnative plants, fuel modification, OHV (recreational use), and climate change (Appendix A).

Subgroup (S-6)

S-6 is the largest subgroup and occurs within the Cities of Chula Vista and San Diego and the un-incorporated County of San Diego, including 13 occurrences in Poggi and Telegraph Canyons, eastern Otay River Valley, Johnson Canyon, and Salt Creek (Figure 1). All of the occurrences are extant or presumed extant except for EO 42 which is unknown status because it is only described in the 2004 recovery plan. Three new occurrences (EO 55, 56, 59) are considered extant since the last 5-year review, though EO 55 and 59 were known at the time (USFWS 2009, Appendix A). The occurrences occur in the City of Chula Vista, City of San Diego, and County of San Diego Subarea Plans. Nine of the 13 occurrences are afforded some degree of conservation including three that are fully conserved. An additional 4 occurrences are currently not conserved; but 2 of the 4 are within the preserve design of the regional HCPs and will at least be partially conserved in the future. Current threats to this area include urbanization in areas not conserved, nonnative plants, fuel modification, OHV (recreational use), and climate change (Appendix A).

Subgroup (S-7)

S-7 contains only one extant occurrence on the CDFW Rancho Jamul Ecological Preserve (EO 54; Figure 1). EO 54 is fully conserved and is within the County of San Diego Subarea Plan boundaries. Current threats include nonnative plants, fuel modification, and climate change (Appendix A).

Subgroup (S-8)

S-8 contains two occurrences near the U.S-Mexico Border (EOs 11 and 58; Figure 1). EO 58 is a new extant occurrence since the last 5-year review that occurs within the City of San Diego

Subarea Plan. Current threats include urbanization, nonnative plants, off-highway vehicles (OHV), and climate change (Appendix A). EO 11 has been extirpated since listing.

Subgroup (S-9)

S-9 contains one, extant occurrence in eastern Otay Mesa within the County of San Diego Subarea Plan (Figure 1). EO 5 is on private land and is partially conserved through a conservation easement. Current threats to the area include urbanization, nonnative plants, OHVs, and climate change (Appendix A). Herbivory, potentially by rabbits, was observed on individuals that were seeded as part of a restoration effort at the Otay Mesa Energy Center (RECON 2022, p. 14 and Table 9). Potential impacts were reduced through the installation of exclusion fencing. EO 30 is considered extirpated since the last 5-year review due to urbanization.

Baja California occurrences in Mexico

Within Mexico, *Deinandra conjugens* is found in the municipalities of Tijuana, Rosarito, and along the northern limit with Ensenada. There are 46 total records in Baja California, Mexico that extended the distribution south relative to the distribution known at the 2009 5-year review. We have identified the spatial distribution of *D. conjugens* in Mexico to include 15 occurrences, of which 13 are considered extant based recent observations and a review of 2022 aerial imagery (Table 3; Figure 2; Appendix B). Only one of these occurrences were known at listing (USFWS 1998, p. 54939) and 7 additional historical records were determined to be a different species, *D. paniculate* (Vanderplank 2023a, pers. comm). Due to lack of data on genetics and the extent of suitable habitat in Mexico, occurrences of *D. conjugens* in Baja California, Mexico were not separated into population subgroups (Figure 2). The main threat in Baja California is urbanization followed by agriculture (SDZWA 2022, pp. 5–6). It is also worth noting that *D. conjugens* in Mexico was recently determined to have both staminode and female disk flowers, while it only has staminode disk flowers in California (Vanderplank 2023b, pers. comm.). It is not clear if the difference is due to plasticity or has a genetic basis.

Table 3. Summary of *Deinandra conjugens* occurrence status in Baja California, Mexico in 2023.

Occurrence status	Number of occurrences in 2023
Extant	13
Presumed Extant	2
Possibly Extirpated	1
Extirpated	2
Occurrence total	**18**

Abundance

The number of standing, vegetative plants of *Deinandra conjugens* detected in any given population can vary by orders of magnitude from year to year primarily due differences in the timing and quantity of annual rainfall. Because the species is an annual, the number of standing

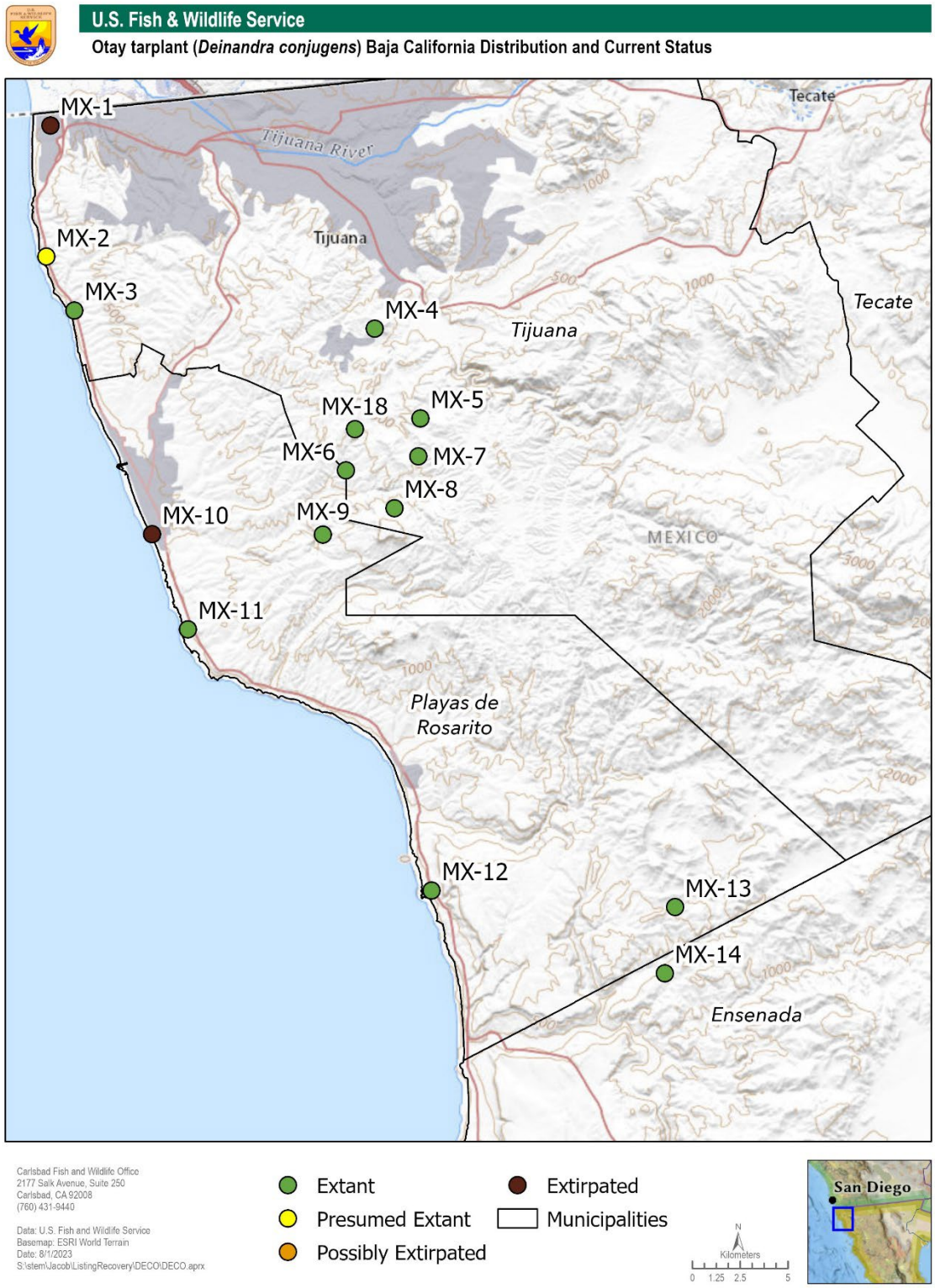

Figure 2. *Deinandra conjugens* distribution and status of occurrences within Baja California, Mexico.

plants observed in a population in any one year may not accurately reflect the population size; and much of the population's reproductive capacity rests in the persistent soil seedbank. It is not clear how long dormant *D. conjugens* seeds can remain viable in the soil and we lack information on the potential size or geographical extent of the species' soil seedbank. In addition, population estimates based on CNDDB EO descriptions include efforts by different surveyors, different survey methods, and may not have include the entire area occupied making year-to-year comparisons difficult.

In the 1998 listing rule, we estimated that there were approximately 300,000 standing individuals of *Deinandra conjugens* (USFWS 1998, p. 54939). The largest "population" recorded at that time was the Rancho San Miguel Complex at about 196,000 individuals (Roberts 1997, p. 7), which when combined with four other locations – Rice Canyon South, Poggi Canyon, Proctor Valley, and Dennery Canyon – represented 90 percent of the known individuals at the time (Roberts 1997, pp. 7–8; USFWS 2009, p. 15). In our 2009 5-year review, we presented a status update based on surveys conducted in 2003 at 13 of the 34 extant occurrences known at the time. A total partial population estimate of 263,500 plants was derived based on surveys at approximately 38 percent of the extant occurrences (McMillan 2003, pp. 1–11; USFWS 2009, Appendix A). At that time, we cautioned that due to the differences in locations, timing of surveys, and location of surveys, the population estimates from 2003 were not directly comparable to previous status assessments (USFWS 2009, p. 16). However, the 2003 survey results suggested that population estimates were likely higher than known at listing both due to increased abundance and additional occurrences.

To characterize abundance for this 5-year review, we utilized the generalized population size classes for annuals developed by SDMMP (SDMMP 2021, Table 3.6.-1). We calculated the average abundance reported over the last 10 years of available data, consistent with the period we used to characterize an occurrence as extant; and applied the abundance categories as follows: small size populations include less than 1,000 individuals; medium populations include 1,000-10,000; and large populations were defined as greater than 10,000 individuals based on visual estimates of above-ground individuals. Based on the 29 extant or presumed extant occurrences, 10 were in the small size class, 10 in the medium size class, and 8 occurrences were considered large; and the different size classes were spread across the species distribution and across genetic subgroups. The largest records were in fact very large including East of Dennery Ranch with approximately 3.8 million individuals recorded in 2019 (EO 6; S-5), Jamacha Boulevard (EO 38; S-1) with 2.1 million individuals, Sweetwater Reservoir-South (EO 10; S-3) with greater than 1 million, and Rancho Jamul Ecological Reserve (EO 54; S-7) with greater than 500,000. Estimates based largely on 2019 data, which was approximately 20 percent above average rainfall, indicated that there was greater than 8 million standing individuals. Similar results were found on conserved lands, SDMMP determined that 56 percent of the occurrences supported medium (1,000-10,000) to large (>10,000) populations and overall population size was stable across 73 percent of the occurrences (SDMMP 2021, pp. 216–217).

Summary

As of 2023, there are 36 extant or presumed extant occurrences in the United States and no occurrences were extirpated since the last 5-year review in 2009 (Appendix A). Based on recent survey efforts, new occurrences and records were discovered throughout the U.S. range, slightly

expanding the distribution of *Deinandra conjugens* relative to its historical distribution. Coarse population estimates in 2019 recorded greater than 8 million standing individuals, suggesting that the abundance of *D. conjugens* is potential much higher than previously reported and supporting the statement that the species can take advantage of favorable climate conditions. Since the last 5-year review, research has determined the presence of one genetic cluster for occurrences of *D. conjugens* within the United States. A study on soil characteristics determined a positive relationship between *D. conjugens* and clay, sodium, magnesium, and low fertility soils that can be used to guide future restoration and management efforts. Additionally, recent surveys reported that there are 15 extant or presumed extant occurrences in Baja California, Mexico, greatly increasing our understanding of the species distribution which was limited to one occurrence at listing (USFWS 1998, p. 54939).

Threats

The threats to *Deinandra conjugens* identified at the time of listing include: 1) urbanization, 2) OHV activity, 3) trampling/grazing, and 4) nonnative plants (USFWS 1998, pp. 54945–54950). Since listing, the effects of climate change have been identified as an additional threat to *D. conjugens*. Additionally, up to 21 different threats have been recorded on lands conserved by the MSCP and monitored by SDMMP (SDMMP 2021, p. 219). For our analysis, we considered a threat as potentially affecting the species status if SDMMP identified that it was impacting over 25 percent or more of the occurrence and was considered a medium to high management priority (SDMMP 2021, Table 4.4-5). The current status of threats to *D. conjugens* are discussed below.

Urbanization

At the time of listing, urbanization was described as the primary threat to *Deinandra conjugens* (USFWS 1998, pp. 54945–54946). Impacts to *D. conjugens* from urbanization include direct effects (loss of habitat) and indirect effects (changes to native plant communities, colonization by nonnative plants, or disruption of hydrological patterns). As noted in our 2009 5-year review, since listing, habitat loss for *D. conjugens* has generally been accompanied by permanent habitat protection and management efforts (USFWS 2009, p. 18). For example, we indicated that although areas of two large occurrences, Rancho San Miguel and Proctor Valley, were lost to urbanization, the remaining occupied areas within these locations became protected from future urbanization by being incorporated into preserve areas established with the implementation of the San Diego MSCP Subregional Plan or are now managed as part of the San Diego NWR (USFWS 2009, p. 18). In addition, implementation of the Subarea Plans under the San Diego MSCP has provided an important protective mechanism from urbanization for areas occupied by *D. conjugens*. In our 2009 5-year review, we reported results from a GIS assessment of *D. conjugens* (polygons and point-locations) relative to their location within the boundaries of the MSCP Subarea Plans and preserve lands (USFWS 2009, p. 5). We concluded that 80 percent of the locations defined by polygons and 50 percent of point locations were found within the lands defined by the San Diego MSCP, and 282 ac (114 ha) and 44 percent of the point locations were within preserved lands (USFWS 2009, p. 5).

In addition, *Deinandra conjugens* is a covered species under two regional HCPs: the San Diego County Water Authority Habitat Conservation Plan and the San Diego Gas and Electric Subregional Plan. Both plans include avoidance and mitigation measures for *D. conjugens*

associated with utility projects and both plans have designated preserve lands that benefit the species.

Urbanization is a potential threat to 25 of the 36 occurrences that are extant or presumed extant, but the degree of threat varies depending on the extent to which the occurrence is conserved (Appendix A). As discussed in more detail below under Conservation Status, protections afforded under the approved regional MSCP have largely ameliorated the threat of urbanization. Currently, these plans afford some degree of protection to 34 of the 36 extant or presumed extant occurrences. Based on an overestimate of the area occupied derived from CNDDB polygons that capture unoccupied habitat between records that are less than a quarter mile apart, there are approximately 2,430 acres [ac (983 hectares; ha)] of occupied habitat of which 40 percent (954 ac; 386 ha) are conserved in the United States. Only 6 of the 36 extant or presumed extant occurrences are currently not conserved (EO 11, 16, 30, 41, 58, and 59) and are not afforded any monitoring or management (Appendix A).

In Baja California, Mexico, threats due to habitat loss and degradation associated with urbanization and agriculture were identified at 7 of the 15 extant or presumed extant occurrences and were the only threats identified during surveys. However, we expect that many of the same threats that occur in the United States also occur in Mexico, such as nonnative plants, OHV activity, and vegetation clearing. Also, climate change is a global threat also affecting the occurrences in Mexico. We are not aware of any mechanism to ameliorate threats or conserve these occurrences.

Nonnative Plants

In our 2009 5-year review, we stated that competition with nonnative plants, particularly the potential for decreased seed production, was a significant, rangewide threat to *Deinandra conjugens* (USFWS 2009, p. 24). In addition, to resource competition nonnative annual grasses and the associated thatch can also preclude germination resulting in reduced annual abundance (CBI 2017, p. 1; Vinje 2023, pers. comm.). A 2017 study at the Rancho Jamul Ecological Reserve evaluated techniques for controlling nonnative grasses and provided recommendations for best management practices that emphasize the beneficial effects of grass specific herbicide treatments (CBI 2017, entire).

Currently, nonnative plants are listed as a threat to 30 of the 36 occurrences that are extant or presumed extant in San Diego County, though the magnitude of the threat varies depending on the degree that the occurrence is managed and conserved. Management actions within preserves established under the San Diego MSCP primarily consist of the removal of thatch (layer of living and dead stems, roots, and rhizomes above the soil surface), particularly dead herbaceous thatch, and herbicide applications. For example, dethatching and spot spraying has been used to control nonnative plants within the Rice Canyon occurrence of *Deinandra conjugens* (EO 9) as part of restoration and enhancement projects (City of Chula Vista 2014, p. 16; RECON 2021, entire). An increase in the population of *D. conjugens* was observed from 2011 to 2013 at this occurrence, along with a decrease in nonnative cover and an increase in native plant cover, associated with nonnative plant control, seed dispersal and planting activities (City of Chula Vista 2014, pp. 14–17). Additionally, at the Sweetwater Reservoir-South occurrence (portions of EO 10), dethatching and dead biomass removal has been successful in controlling nonnative

plants (RECON 2013b, p. 27). Management actions were also implemented to control nonnative grass thatch at the Rancho Jamul Ecological Reserve (EO 54), Rice Canyon (EO 9, 50), Johnson Canyon (EO 37), and Poggi and Telegraph Canyons (EO 7; CBI 2017, entire; RECON 2013, entire; RECON 2021, entire; CALTRANS 2022, entire). Ongoing management actions will be required to ensure that this threat is controlled, particularly for occurrences that are accessible to the public. We do not have information to describe the extent of the threat of nonnative plants in Mexico.

Off-Highway Vehicle Use

In our listing rule, we identified OHV activity as a threat to *Deinandra conjugens* (USFWS 2002, p. 54946). In our previous 5-year review, we stated that OHV activity was recognized as a threat at 11 of 34 occurrences of *D. conjugens* (citing McMillan 2003, pp. 1–10), and continued to be so at 7 of 34 extant occurrences in 2009 (USFWS 2009, p. 20). OHV activity may modify *D. conjugens* habitat by promoting erosion, compacting the soil (especially if OHV activity occurs on wet soils), and encouraging invasion by nonnative plants (Kuss 1986, pp. 637–650). OHV activity can also crush or damage the above-ground portions of individual annual plants, depending on the timing of the activity, potentially disrupting reproduction. Impacts to *D. conjugens* associated with OHV activity was identified as a localized threat to 12 of 36 U.S. occurrences (Appendix A).

Although we have no current, comprehensive surveys for all occurrences of *Deinandra conjugens*, annual San Diego MSCP Subarea Plan monitoring reports have provided information regarding the impact of OHV and other recreational activities at several locations. For example, monitoring was conducted in 2012 at multiple sites within the Otay Ranch Preserve to identify previously undetected plant and animal species, weeds, and the overall health of the preserve (RECON 2013a, pp. 9–10). Recreational access issues (and weeds) were described during surveys within the occupied Salt Creek occurrence of *D. conjugens* (EOs 18 and 42; RECON 2013a); however, management actions have been installed at some locations to minimize or eliminate access. For example, fencing and signs were installed at access roads and along the eastern boundary fence near the Salt Creek occurrence to limit OHV access (RECON 2013a, p. 24). Fencing was also installed along the southern boundary of the eastern portion of the Otay River occurrence (EOs 15 and 40) (also known as the Salt Creek FUDS area; RECON 2013a, p. 24).

Within the City of San Diego MSCP Subarea Plan, management actions were conducted in 2012 to control public access in urban canyons. These included the removal of homeless encampments from the Paradise Canyon area (EO 60), and placement of rock barriers/pipe gates at several other urban canyons to prevent dumping, unwanted vehicle entry, and other impacts to native habitat (City of San Diego 2013, p. 12). Additionally, protective fencing and signage were installed in Rice Canyon (EO 9) in 2021 (RECON 2021, pp. 1–3). Ongoing management (i.e., fence repair) will be required in the future to ensure that this threat is reduced or eliminated at these and other occurrences that are accessible to the public.

Fuel Modification

Fuel modification, the creation and maintenance of fire breaks or fuel breaks, is a practice often used for wildland fire management that may impact individuals or modify *Deinandra conjugens* habitat in the areas affected. Maintenance of firebreaks was mentioned in our 2004 recovery plan as a threat to *D. conjugens* at two CNDDB-defined occurrences – EO 3 and portions of (current) EO 10 (USFWS 2004, p. 13). Additionally, fuel modification is an identified threat at EOs 6, 34, 35, 37, 46, 49, 54, and 57, though most plants are not likely to be impacted on these eight occurrences because we expect that they will be avoided on conserved lands (CNDDB 2023, entire).

Climate Change

Impacts to *Deinandra conjugens* associated with climate change were not identified as a threat at the time of listing. Our analysis under the Act now includes consideration of ongoing and projected changes in climate conditions. The range of *D. conjugens* in southern San Diego County is projected to become more arid with forecasted increases in temperature and greater variability in precipitation, including the potential for prolonged droughts and extreme precipitation events (Cal-Adapt 2013b). Wildfire risk is also expected to increase due to more arid conditions and the increase in vegetation biomass and fuel load that follow high precipitation El Niño events. Increasing drought stress and wildfire risk are a threat to *D. conjugens* throughout its range in the United States and Mexico.

SDMMP developed habitat suitability models for *Deinandra conjugens* under future climate scenarios (CBI 2018, p. 16). The results project that there would be no suitable habitat for this species in the region under any of the global climate models, representative concentration pathways (RCPs), and time periods used in their assessment. However, due to uncertainties it is difficult to reliably predict the species response over this time. *Deinandra conjugens* is also known to have a persistent soil seed bank due to its hard seed coat, which may help to ensure persistence into the future, but the length of seed dormancy is still largely unknown. We have limited, anecdotal information that field seed dormancy is at least 10 years based on a nonnative grass control project (CBI 2017, p. 1; SDMMP 2021, pp. 215–216) and laboratory germination studies (Birker 2023, pers. comm). Following these management actions, individuals germinated from the existing seed bank. This result suggests some ability to buffer against drought conditions; however, we currently lack data to predict the timing and magnitude of the species response to climate change effects.

Summary of Threats

The primary threats to *Deinandra conjugens* is urbanization and nonnative plants. Impacts related to urbanization have been largely reduced since the time of listing due to the implementation of the Subarea Plans for the San Diego MSCP. Nonnative plants, particularly annual grasses, continue to represent a rangewide threat to *D. conjugens*, and, at some occurrences, this threat will require continued management. Potential impacts due to climate change effects are projected, though we currently have limited information to characterize the magnitude of impact in the near-term.

Conservation Status

The MSCP identifies areas where permanent conservation of habitat will be achieved through the Subarea Plans developed by local jurisdictions and special districts. The Multi-Habitat Planning Area (MHPA) is the area within which the permanent MSCP preserve will be assembled and managed for its biological resources. The MHPA is designed to protect interconnected areas of different vegetation communities or habitats and maximize the protection of the region's most sensitive species (City of San Diego 1998, p. 2). *Deinandra conjugens* is identified in the MSCP as a narrow endemic species, which provides it with an additional layer of protection through the application of specific conservation measures identified within Subarea Plans (City of San Diego 1998, pp. 3–27). Framework management plans also provide guidance on management responsibilities for the various preserves within the various Subarea Plans. The Subarea Plans approved area-specific management directives and are also required to address management issues at the site-specific level (City of San Diego 1998, pp. 6–7). *Deinandra conjugens* and its habitat are protected under the County of San Diego, City of Chula Vista, and City of San Diego Subarea Plans. Annual reports, regular agency meetings, and other coordination activities ensure that the Plans are being managed in accordance with the implementing agreements, and that conservation of covered species such as *D. conjugens* are being implemented.

Table 4. Summary of extant *Deinandra conjugens* occurrence conservation status in San Diego County as of 2023.

Conservation status	Number of occurrences in 2023
Conserved	11
Mostly Conserved	11
Half Conserved	2
Partially Conserved	10
Not Conserved	5
Occurrence total	**39**

For this 5-year review, we conducted a GIS analysis to identify those extant and presumed extant occurrences of *Deinandra conjugens* located within MSCP Subarea Plans, inside MHPA preserve lands, and whether those areas or point locations are currently considered conserved. Conservation status was characterized based on the proportion of the EO area conserved: Conserved (>95%), Mostly Conserved (55-95%), Half Conserved (45-55%), Partially Conserved (<45%), and Not Conserved (<5%). The majority of occurrences (24 of 36 extant or presumed extant occurrences) are greater than 45 percent conserved (Table 4; Appendix A). Conservation status was characterized based on CNDDB EOs that include the habitat area between records that are within a quarter mile of each other; and therefore, overestimate the acreage of *D. conjugens* occupied habitat. As a result, the conservation status for the actual area occupied is likely higher than reported. Of the five extant occurrences currently not conserved, two are within the MHPA and are likely to be partially conserved in the future as the regional preserve designs are

implemented (EO 7, 16 in S-6). In addition, SDMMP monitors 27 occurrences on conserved lands in the Management Strategic Planning Area (SDMMP 2021, p. 209).

Critical Habitat

In 2002, we designated 6,330 ac (2,560 ha) of critical habitat for *Deinandra conjugens*. Approximately 68 percent of designated critical habitat is currently conserved and an additional 964 ac (389 ha) are anticipated to be preserved in the future within the MHPA preserve boundary. As a result, 83 percent of *D. conjugens* critical habitat is anticipated to be preserved.

CONCLUSION

In the 2009 5-year review, we recommended no status change for *Deinandra conjugens*. Since 2009, we have received new occurrence information for *D. conjugens*, and new information regarding threats to the species. Based on currently available information, there are 36 occurrences of *D. conjugens* extant or presumed extant in the United States. Although, seven occurrences are extirpated due to development projects these occurrences were mitigated through the conservation or augmentation. The current distribution of *D. conjugens* has expanded to the north and northwest in the United States as a result of new occurrences since listing and the 2009 5-year review. There are also 15 extant or presumed extant occurrences in Baja California, Mexico that extended the current distribution south relative to the distribution known at the 2009 5-year review. Evaluation of the threats affecting the species under the factors in 4(a)(1) of the Act determined that the threats of urbanization, nonnative plants, and OHV use have been ameliorated to varying degrees in occurrences within San Diego County since the last 5-year review in 2009, particularly on conserved lands. Management activities to control nonnative plants and reduce recreational impacts by limiting access to the public are on-going and will require future management, much of which is addressed by the MSCP.

After reviewing the best available scientific information, the current distribution and abundance of *Deinandra conjugens* is greater than what was known at listing and the last 5-year review in 2009. With implementation of the MSCP, the threat of urbanization is largely ameliorated and the threat of nonnative plants, and OHV access are largely addressed through monitoring and management associated with the MSCP. However, large scale habitat loss is also projected from climate change effects. Therefore, no status change is recommended at this time. Instead, based on these influences (changes in threats and conservation measures), we recommend the initiation of a Species Status Assessment to better evaluate the status of *D. conjugens*.

RECOMMENDATIONS FOR FUTURE ACTIONS

The recommended actions listed below are based on outstanding actions from the 2004 Recovery Plan for *Deinandra conjugens* (Appendix C; USFWS 2004, entire), SDMMP management objectives (SDMMP 2021, Table 4.4-1), and threats identified in this review. Successful implementation of these actions will further reduce threats to *D. conjugens* and help to recover the species.

1. Work with partners to identify opportunities for conservation or preservation of *Deinandra conjugens* occurrences on private lands. Support land acquisition to meet

Habitat Conservation Plan goals. Work with local, State, and Federal partners to identify and leverage funding (i.e., section 6) to acquire *D. conjugens* habitat.

2. Adaptively manage *Deinandra conjugens* occurrences to maintain, enhance, or restore habitat and reduce threats.

    a. Continue to manage the threat of nonnative plants (i.e., invasive annual grasses) through de-thatching and direct control.

    b. Restore or augment small and/or declining extant occurrences once threats have been ameliorated.

3. Monitor occurrences (evaluate habitat quality) and assess management effectiveness.

    a. Conduct surveys to evaluate the status of populations that have not been visited in the last 10 years.

    b. Conserve *Orcuttia californica* seed in an off-site seed bank and develop associated storage techniques to support research, restoration, and management.

4. Improve habitat connectivity for pollinators and seed dispersers to maintain gene flow.

    a. Determine the level of variability in the self-compatibility allele within and among populations.

    b. Identify the habitat requirements of potential pollinators.

    c. Develop techniques for germination, propagation, and habitat restoration to improve connectivity.

5. Extend the genetic study to new occurrences in Baja California, Mexico.

6. Protect habitat supporting known populations of *Deinandra conjugens* outside of MSCP participating jurisdictional control.

7. Develop conservation related outreach materials.

8. Engage with the Mexican government regarding measures to conserve known populations.

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APPENDIX A

Summary of Occurrences in the United States

Table A1. Occurrence table for *Deinandra conjugens* occurrences in the United States, showing CNDDB EO number, occurrence status in 1998, 2009, and 2023, size class, landownership, threats, and conservation status.

Location	Occurrence Name	Subgroup	EO	SDMMP ID	1998 Status	2009 Status	2023 Status	Size Class	First Observed	Last Observed	Former EO's	Land Ownership	2023 Threats	Conservation Status (Future Status) [2]	Preserve	Conservation Mechanism (Subarea Plan)	References
Sweetwater Valley	Sweetwater Reservoir-North	S-1	3	NA	Extant	Extant	Extant	Small	1994	2023	NA	Sweetwater Authority, Private	A. Urbanization, nonnative plants; E. Climate Change	Mostly Conserved	Sweetwater Regional Park, Sweetwater Reservoir Open Space	County	CNDDB 2023; Famolaro 2023; pers. comm.
Jamacha Valley	Jamacha Hills	S-1	35	DECO13_3JAHI006	Extant	Extant	Extant	Medium	1993	5/28/2020	NA	USFWS-SDNWR	A. Nonnative plants, fuel modification, altered hydrology, dumping; E. Climate Change	Conserved	San Diego NWR	County	CNDDB 2023; SDMMP 2023; CCH2 2023
Jamacha Valley	Jamacha Boulevard	S-1	38	DECO13_3JABO028	NA	Extant	Extant	Large	1994	5/19/2020	NA	Private, USFWS SDNWR	A. Urbanization, nonnative plants; E. Climate Change	Mostly Conserved	San Diego NWR	County	CNDDB 2023; SDMMP 2023; CCH2 2023
Sweetwater Valley	Along State Highway 125 @ Briarwood	S-1	24	NA	Extant	Extirpated	Extant	NA	1992	7/13/2017	25	CALTRANS, Private, County of SD	A. Urbanization, nonnative plants; E. Climate Change	Partially Conserved	Local Baseline Acquisition	City of SD and County	CNDDB 2023; CCH2 2023
Sweetwater Valley	Sweetwater Reservoir-North	S-1	47	NA	NA	Possibly Extirpated	Extant	NA	2003	2018	NA	Sweetwater Authority, Private	A. Nonnative plants; E. Climate Change	Conserved	Sweetwater Reservoir Open Space	County, Conservation Easement	CNDDB 2023; Famolaro 2023; pers. comm.; USFWS 2004
Southeast San Diego	Paradise Valley	S-2	52	DECO13_2PAVA001	NA	NA	Extant	Medium	2001	6/1/2020	NA	City of SD	A. Nonnative plants; E. Climate Change	Conserved	Paradise Hills Community Park	City of SD	CNDDB 2023; SDMMP 2023; CCH2 2023
Location	**Occurrence Name**	**Subgroup**	**EO**	**SDMMP ID**	**1998 Status**	**2009 Status**	**2023 Status**	**Size Class**	**First Observed**	**Last Observed**	**Former EO's**	**Land Ownership**	**2023 Threats**	**Conservation Status**	**Preserve**	**Conservation Mechanism (Subarea Plan)**	**References**

														(Future Status) [2]			
Southeast San Diego	Valencia Canyon	S-2	53	NA	NA	NA[1]	Presumed Extant	Unknown	2001	2001	NA	City of SD	A. Nonnative plants; E. Climate Change	Conserved	Valencia Canyon	City of SD	CNDDB 2023
Southeast San Diego	Paradise Gardens	S-2	60	DECO13_2PAVA030	NA	NA[1]	Extant	Medium	2018	6/1/2020	NA	City of SD	A. Nonnative plants; E. Climate Change	Conserved	Paradise Gardens	City of SD	CNDDB 2023; SDMMP 2023; CCH2 2023
San Miguel Mountains/ Proctor Valley	Rolling Hills Ranch	S-3	19	DECO13_3RHRA012 DECO13_3PRVA014 DECO13_3RHRA029	Extant	Extant	Extant	Medium	2000	5/23/2019	21, 22	Private, USFWS, City of SD	A. Urbanization, nonnative plants, OHV; E. Climate Change	Partially Conserved (Half Conserved)	City of Chula Vista, Central City Preserve, Otay Lakes Cornerstone Lands, Rolling Hills Ranch, SDNWR	City of CV, City of SD, and County	CNDDB 2023; SDMMP 2023
San Miguel Mountains/ Proctor Valley	Mother Miguel Mountain - Foothills	S-3	34	DECO13_3SMHA024	Extant	Extant	Extant	Small	1993	2022	NA	Otay MWD	A. Urbanization, nonnative plants, fuel modification, OHV, altered fire regime; E. Climate Change	Half Conserved	San Miguel Habitat Management Area	NA	CNDDB 2023; SDMMP 2023; CCH2 2023; Merkel 2023
San Miguel Mountains/ Proctor Valley	Proctor Valley	S-3	46	DECO13_3PRVA013	NA	NA[1]	Extant	Small	2000	6/5/2020	NA	City of SD, USFWS, Private	A. Urbanization, nonnative plants, fuel modification, OHV; E. Climate Change	Mostly Conserved	Otay Lakes Cornerstone Lands, SDNWR	City of CV, City of SD, and County	CNDDB 2023; SDMMP 2023; CCH2 2023
San Miguel Mountains/ Proctor Valley	Mother Miguel Mountain - Foothills	S-3	57	DECO13_3SMHA025	NA	NA[1]	Extant	Small	pre-2009	2022	NA	Otay MWD	A. Nonnative plants, fuel modification; E. Climate Change	Partially Conserved	San Miguel Habitat Management Area	NA	CNDDB 2023; SDMMP 2023; Merkel 2023

Location	Occurrence Name	Subgroup	EO	SDMMP ID	1998 Status	2009 Status	2023 Status	Size Class	First Observed	Last Observed	Former EO's	Land Ownership	2023 Threats	Conservation Status (Future Status)[2]	Preserve	Conservation Mechanism (Subarea Plan)	References
Sweetwater Valley	Sweetwater Reservoir-South, Rancho San Miguel Complex	S-3	10	DECO13_3SVPC007, DECO13_3BOME009, DECO13_3MMGR010, DECO13_3TRIM008, DECO13_3HOBE031	Extant	Extant	Extant	Large	1989	5/20/2020	20, 23, 32, 33	Private, USFWS, Sweetwater Authority	A. Urbanization, nonnative plants, fuel modification, OHV; E. Climate Change	Mostly Conserved	SDNWR, Bonita Meadows	Water Authority NCCP/HCP (conservation bank); City of CV and County	CNDDB 2023; SDMMP 2023; Famolaro 2023, pers. comm.; CCH2 2023
Sweetwater Valley	Sweetwater Reservoir-South, Rancho San Miguel Complex	S-3	51	NA	NA	NA[1]	Unknown	Unknown	pre-1995	1990's	NA	County of SD	E. Climate Change	Partially Conserved	Sweetwater Regional Park	--	CNDDB 2023; 1995 Recon Report
Chula Vista	Bonita/Long Canyon	S-4	1	NA	Extant	Extant	Extant	Small	1993	4/17/2017	NA	City of CV, Private	A. Urbanization; E. Climate Change	Partially Conserved		City of CV and County	CNDDB 2023
Chula Vista	Rice Canyon	S-4	9	DECO13_3PMA1002	Extant	Extant	Extant	Large	1987	6/4/2019	NA	City of CV, Private	A. Urbanization, nonnative plants, OHV; E. Climate Change	Mostly Conserved	Central City Preserve	City of CV	CNDDB 2023; SDMMP 2023; CCH2 2023
Chula Vista	Bonita/Long Canyon	S-4	48	NA	NA	NA[1]	Presumed Extant	Unknown	2003	2003	NA	City of CV	E. Climate Change	Conserved		City of CV	CNDDB 2023
Chula Vista	Bonita/Long Canyon	S-4	49	DECO13_3PMA4005	NA	NA[1]	Extant	Large	2003	5/14/2019	NA	City of CV	A. Urbanization, nonnative plants, fuel modification, OHV (recreational activity); E. Climate Change	Mostly Conserved	Central City Preserve	City of CV and County	CNDDB 2023; SDMMP 2023; CCH2 2023
Chula Vista	Rice Canyon	S-4	50	NA	NA	NA[1]	Extant	Large	2003	2014	NA	City of CV	A. Invasive nonnative plants; E. Climate Change	Conserved		City of CV	CNDDB 2023

Location	Occurrence Name	Subgroup	EO	SDMMP ID	1998 Status	2009 Status	2023 Status	Size Class	First Observed	Last Observed	Former EO's	Land Ownership	2023 Threats	Conservation Status (Future Status)[2]	Preserve	Conservation Mechanism (Subarea Plan)	References
Otay Valley	Dennery Ranch - East	S-5	6	DECO13_3DREA021, DECO13_3DERA020, DECO13_3DENC022	Extant	Extirpated	**Extant**	Large	1988	6/5/2020	17, 27-29, 39	Private, City SD, Others	A. Urbanization, nonnative plants, fuel modification, OHV (recreational activity); E. Climate Change	Mostly Conserved	Dennery Ranch	City of CV and City of SD	CNDDB 2023; SDMMP 2023; CCH2 2023 ; City of San Diego 2004
Otay Mesa	Otay Mesa-West (including Spring Canyon, Moody Canyon, Beyer Hills)	S-5	43	NA	NA	Extant	Extant	Medium	1996	6/8/2020	NA	City of SD	A. Urbanization, nonnative plants; E. Climate Change	Partially Conserved		City of SD	CNDDB 2023
Otay Mesa	Moody Canyon - West	S-5	44	DECO13_3WMCA023, DECO13_3OMEA026	NA	NA[1]	Extant	Medium	2003	6/4/2019	NA	County of SD, City of SD	A. Urbanization, nonnative plants; E. Climate Change	Mostly Conserved	Cal Terraces	City of SD	CNDDB 2023; USFWS 2004; SDMMP 2023; CCH2 2023
Otay Mesa	Otay Mesa-West (including Spring Canyon, Moody Canyon, Beyer Hills)	S-5	45	NA	NA	NA[1]	Extant	Small	1998	6/19/2017	NA	Private	A. Urbanization, nonnative plants; E. Climate Change	Partially Conserved (Mostly Conserved)		City of SD	CNDDB 2023
Chula Vista	Poggi and Telegraph Canyons	S-6	7	DECO13_3PMA2003, DECO13_3PMA3004	Extant	Possibly Extirpated	**Extant**	Medium	1990	5/22/2019	2, 8, 26	Private, City of CV	A. Urbanization, nonnative plants; E. Climate Change	Not Conserved (Partially Conserved)	Central City Preserve	City of CV and County	CNDDB 2023; SDMMP 2023; CCH2 2023
Otay Valley	Otay River Valley	S-6	12	NA	Extant	Extant	Extant	Medium	1990	5/31/2018	NA	Private, City of CV	A. Urbanization, nonnative plants, OHV (recreational activity); E. Climate Change	Partially Conserved		City of CV, City of SD, and County	CNDDB 2023; CCH2 2023

Location	Occurrence Name	Subgroup	EO	SDMMP ID	1998 Status	2009 Status	2023 Status	Size Class	First Observed	Last Observed	Former EO's	Land Ownership	2023 Threats	Conservation Status (Future Status)[2]	Preserve	Conservation Mechanism (Subarea Plan)	References
Otay Valley	Wolf Canyon/Otay River Valley - North	S-6	13	DECO13_3ORVA018	Extant	Extant	Extant	Medium	1990	5/24/2019	14	Private, City of CV	A. Urbanization, nonnative plants; E. Climate Change	Partially Conserved (Half Conserved)	Central City Preserve	City of CV	CNDDB 2023; SDMMP 2023; CCH2 2023; RECON 2013
Otay Valley	Wolf Canyon/Otay River Valley - North	S-6	13	DECO13_3ORVA018	Extant	Extant	Extant	Medium	1990	5/24/2019	14	Private, City of CV	A. Urbanization, nonnative plants; E. Climate Change	Partially Conserved (Half Conserved)	Central City Preserve	City of CV	CNDDB 2023; SDMMP 2023; CCH2 2023; RECON 2013
Chula Vista	Sunbow	S-6	59	NA	NA	NA[1]	Extant	Unknown	2005	9/2/2020	NA	Private	A. Urbanization; E. Climate Change	Not Conserved		City of CV	CNDDB 2023
Otay Valley	Otay River Valley - East	S-6	15	DECO13_3ORVA017	Extant	Extant	Presumed Extant	Small	1990	4/19/2010	NA	City of CV	A. Nonnative plants, OHV; E. Climate Change	Conserved	Otay Ranch Preserve	City of CV and County	CNDDB 2023; SDMMP 2023
Otay Valley	Otay River Valley	S-6	16	NA	Extant	Extant	Unknown	Unknown	1990	2003	NA	City of CV	A. Urbanization, nonnative plants, OHV; E. Climate Change	Not Conserved (Partially Conserved)		City of CV	CNDDB 2023; USFWS 2009
Otay Valley	Salt Creek	S-6	18	DECO13_3SCPA016	Extant	Extant	Extant	Large	1989	6/4/2019	NA	City of CV	A. Urbanization, nonnative plants; E. Climate Change	Mostly Conserved	Central City Preserve	City of CV	CNDDB 2023; SDMMP 2023
Otay Valley	Johnson Canyon	S-6	37	DECO13_3JOCA019	NA	Extant	Extant	Large	2001	5/20/2019	NA	City of CV, CALTRANS	A. Nonnative plants, fuel modification, OHV; E. Climate Change	Conserved	OVRP	County	CNDDB 2023; SDMMP 2023; CALTRANS 2022
Otay Valley	Otay River Valley	S-6	40	NA	NA	Extant	Presumed Extant	Small	2010	3/16/2010	NA	City of CV	A. Nonnative plants; E. Climate Change	Mostly Conserved (Conserved)		City of CV	CNDDB 2023
Otay Valley	Johnson Canyon	S-6	41	NA	NA[1]	Extant	Presumed Extant	Unknown	1997-2000	2000	NA	Private	A. Urbanization, nonnative plants; E. Climate Change	Not Conserved		County	CNDDB 2023
Location	**Occurrence Name**	**Subgroup**	**EO**	**SDMMP ID**	**1998 Status**	**2009 Status**	**2023 Status**	**Size Class**	**First Observed**	**Last Observed**	**Former EO's**	**Land Ownership**	**2023 Threats**	**Conservation Status (Future Status)[2]**	**Preserve**	**Conservation Mechanism (Subarea Plan)**	**References**
Otay Valley	Salt Creek	S-6	42	NA	NA	Extant	Unknown	Unknown	NA	UNK	NA	City of CV	A. Nonnative plants;	Conserved		City of CV	CNDDB 2023; USFWS 2004

													E. Climate Change				
Otay Valley	Lonestar	S-6	55	DECO13_3LOST027	NA	NA[1]	Extant	Small	2002-2007 (unknown)	6/4/2019	NA	Private	A. Nonnative plants; E. Climate Change	Mostly Conserved	Lonestar Preserve	City of SD and County	CNDDB 2023; SDMMP 2023; CCH2 2023
Otay Valley	Salt Creek	S-6	56	NA	NA	NA	Presumed Extant	Unknown	2012	2012	NA	Private	A. Urbanization; E. Climate Change	Half Conserved		City of CV	CNDDB 2023
Rancho Jamul	Rancho Jamul Ecological Reserve	S-7	54	DECO13_3RJER015	NA	Extant	Extant	Large	2001	6/16/2020	NA	DFG - Rancho Jamul ER	A. Nonnative plants, fuel modification, wildfire; E. Climate Change	Conserved	Rancho Jamul ER	County	CNDDB 2023; SDMMP 2023; CCH2 2023; CBI 2017
Otay Mesa	Otay Mesa-East	S-8	58	NA	NA	NA	Extant	Medium	2012	6/3/2020	NA	Private	A. Urbanization, nonnative plants, OHV; E. Climate Change	Not Conserved		City of SD	CNDDB 2023
Otay Mesa	Otay Mesa-East	S-8	11	NA	Extirpated	Extirpated	Extirpated	NA	1980s	1980s	NA	Private	A. Urbanization, nonnative plants, OHV; E. Climate Change	Not Conserved (Partially Conserved)		City of SD	CNDDB 2023; USFWS 2004
Otay Mesa	Otay Mesa-East	S-9	5	NA	Extant	Extant	Extant	Small	1985	4/24/2015	31, 36	Private	A. Urbanization, nonnative plants, OHV, altered fire regime; E. Climate Change	Partially Conserved		County	CNDDB 2023; CCH2 2023; RECON 2022
Otay Mesa	Otay Mesa-East	S-9	30	NA	Extant	Extirpated	Possibly Extirpated	NA	1991	6/5/1991	NA	Unknown	A. Urbanization, nonnative plants, altered fire regime; E. Climate Change	Not Conserved		City of SD	CNDDB 2023
Casa de Oro	Mount Helix	**NA**	NA	NA	Extirpated	Extirpated	Extirpated	NA	7/22/1937	7/22/1937	NA	Private	NA	NA	NA	NA	CCH2 2023
Chula Vista	Bonita/Long Canyon	**NA**	NA	NA	Extirpated	Extirpated	Extirpated	NA	6/8/1993	6/8/1993	NA	Private	NA	NA	NA	NA	CCH2 2023
Location	**Occurrence Name**	**Subgroup**	**EO**	**SDMMP ID**	**1998 Status**	**2009 Status**	**2023 Status**	**Size Class**	**First Observed**	**Last Observed**	**Former EO's**	**Land Ownership**	**2023 Threats**	**Conservation Status (Future Status)[2]**	**Preserve**	**Conservation Mechanism (Subarea Plan)**	**References**
Chula Vista	East Lake	**NA**	NA	NA	Extirpated	Extirpated	Extirpated	NA	6/18/1936	6/18/1936	NA	Private	NA	NA	NA	NA	CCH2 2023
Southeast San Diego	Paradise Village	**NA**	NA	NA	Extirpated	Extirpated	Extirpated	NA	6/16/1936	6/16/1936	NA	Private	NA	NA	NA	NA	CCH2 2023

Sweetwater Valley	Bonita/Sweetwater Valley	**NA**	NA	NA	Extirpated	Extirpated	Extirpated	NA	7/7/1992	7/7/1992	NA	Private	NA	NA	NA	NA	CCH2 2023
Sweetwater Valley	La Presa	**NA**	NA	NA	NA	NA[1]	Extirpated	NA	6/30/2003	6/30/2003	NA	Unknown	NA	NA	NA	NA	CCH2 2023

[1]Indicates occurrences that were recorded at the time of the status review; but were not reported in the listing rule or 2009 5-year review.

[2] Conservation status describes the area currently conserved. If the conservation status will change in the future once the MHPA preserve design is implemented the new status is indicated in parenthesis.

APPENDIX B

Summary of Occurrences in Baja California, Mexico

Table B1. Occurrence table[1.]

Municipality	Occurrence Name	ID	CCH2 ID	2023 Status	Date First Observed	Date Last Observed	2023Threats	References
Tijuana	Playas de Tijuana	DECO-MX1	UC89081	Extirpated	6/6/1893	6/6/1893	NA	CCH2 2023
Tijuana	Punta Bandera	DECO-MX2	SD21797	Presumed Extant	6/27/1938	6/27/1938	Urbanization	SDZWA 2022
Tijuana	Real Del Mar	DECO-MX3	NA	Extant	5/30/2022	5/30/2022	Urbanization	iNaturalist
Tijuana	Buenos Aires-North	DECO-MX4	SD97209	Extant	5/21/1977	6/6/2022	Urbanization	SDZWA 2022, iNaturalist
Tijuana	Rancho de los Mejía	DECO-MX5	NA	Extant	6/5/2022	6/5/2022		SDZWA 2022
Tijuana	Natura-North	DECO-MX18	NA	Extant	6/6/2022	6/6/2022	Urbanization	SDZWA 2022, iNaturalist
Tijuana	Natura-South	DECO-MX6	NA	Extant	6/7/2022	6/7/2022		SDZWA 2022, iNaturalist
Tijuana	Ejido Mesa Redonda	DECO-MX7	NA	Extant	6/5/2022	6/5/2022		SDZWA 2022, iNaturalist
Tijuana	Cerro Veladero	DECO-MX8	NA	Extant	8/21/2021	6/5/2022		SDZWA 2022, iNaturalist
Rosarito	La Avena	DECO-MX9	NA	Extant	6/5/2022	6/5/2022		SDZWA 2022, iNaturalist
Rosarito	Playas de Rosarito	DECO-MX10	SD21793	Extirpated	6/27/1938	6/27/1938	NA	SDZWA 2022
Rosarito	Playas de Rosarito	DECO-MX11	NA	Extant	6/9/2022	6/9/2022	Urbanization	SDZWA 2022
Rosarito	Venustiano Carranza	DECO-MX12	NA	Extant	6/8/2022	6/8/2022	Urbanization	SDZWA 2022, iNaturalist
Rosarito	El Solano	DECO-MX13	UC1776825	Extant	6/6/1997	6/4/2022		SDZWA 2022, iNaturalist
Ensenada	El Solano	DECO-MX14	NA	Extant	6/4/2022	6/4/2022		SDZWA 2022, iNaturalist

[1.] *Deinandra conjugens* occurrences in Baja California, Mexico, municipality, occurrence name, identification number, status in 2023, date first observed, date last observed, and current threats.

APPENDIX C

Deinandra conjugens Recovery Plan-Implementation Summary

Table C1. Summary of Recovery Tasks.[1]

Priority Number	Action Number	Action Description	Estimated Action Duration (years)	Primary Responsible Parties	2023 Status
1a	1.1	Protect *Deinandra conjugens* habitat within areas identified for preservation under the respective County of San Diego, City of San Diego, and City of Chula Vista MSCP Subarea Plans.	Ongoing	USFWS, CSD, SDC, CC*, CDFG	In Progress
1a	5.7	Develop seed storage techniques for *Deinandra conjugens* and collect seeds from all available sources.	4	USFWS*, CSD, SDC, CCV, CDFG	In progress. Seed plan has been prepared.
1b	5.4	Based on research and monitoring of population dynamics in *Deinandra conjugens* and the extent of genetic variability within the species, determine the number of populations, the spatial distribution, and the amount of suitable and occupied habitat necessary to recover the species.	2	USFWS*, CDFG	Genetic study completed. The amount and distribution of habitat for recovery is still to be determined.
1c	5.3.1	Conduct a baseline census of current genetic structure of populations and genetic diversity of *Deinandra conjugens*.	Continuous	USFWS*, CDFG	Completed (USGS 2018)
1c	5.3.2	Determine the level of variability at the "S locus" within and among populations of *Deinandra conjugens*, and identify isolated populations that may need genetic augmentation.	Continuous	USFWS*, CDFG	Not Started.
2	1.2	Protect habitat supporting known populations of *Deinandra conjugens* outside of MSCP participating jurisdictional control.	Ongoing	USFWS*, CDFG*	In progress. Sweetwater Authority was funded with a planning grant to develop a HCP.
2	2	Evaluate the status of all known populations of *Deinandra conjugens*.	Continuous	USFWS*, CSD*, SDC*, CCV*, CDFG*	Completed, (There are several occurrences that have not been visited in the last 10 years).

Priority Number	Action Number	Action Description	Estimated Action Duration (years)	Primary Responsible Parties	2023 Status
2	3	Conduct surveys to search for new populations of *Deinandra conjugens* and implement actions to protect populations outside of established (or proposed) reserves when necessary to maintain genetic diversity and/or connectivity between larger reserves.	5	USFWS*, CDFG*, CSD, SDC, CCV,	In progress. New occurrences have been recorded mostly on conserved lands.
2	4.1	Develop and implement appropriate techniques to control invasive weeds within suitable *Deinandra conjugens* habitat.	Ongoing	USFWS*, CSD*, SDC*, CCV*, CDFG*	Completed Per SDMMP 2021 Objective MGT-DEV-BMP:DEICON-3.
2	4.2	Develop and implement appropriate management plans for areas conserved for *Deinandra conjugens*.	Ongoing	USFWS*, CSD*, SDC*, CCV*, CDFG*	Completed within MSCP (SDMMP 2021 Framework Rare Plant Management Plan).
2	4.3	Develop and implement a *Deinandra conjugens* monitoring plan for conserved areas.	Ongoing	USFWS*, CSD*, SDC*, CCV*, CDFG	Completed. SDMMP IMG monitoring annually.
2	5.5.1	Conduct research to identify the primary and secondary pollinators of *Deinandra conjugens*.	4	USFWS*, CDFG	Completed (Marschalek and Deutschman 2016)
2	5.5.2	Identify the habitat requirements of *Deinandra conjugens* pollinators and assess population status in conserved areas.	Continuous	USFWS*, CDFG	Not started.
3	5.1	Conduct research to determine the population dynamics of conserved populations of *Deinandra conjugens*.	Continuous	USFWS*, CSD, SDC, CCV, CDFG*	Completed (USGS 2018).
3	5.2	Conduct research to determine ecological requirements of *Deinandra conjugens*.	10	USFWS*, CSD, SDC, CCV, CDFG*	Completed (CBI 2018)

Priority Number	Action Number	Action Description	Estimated Action Duration (years)	Primary Responsible Parties	2023 Status
3	5.3.3	Identify appropriate management techniques to provide genetic exchange and/or genetic augmentation among *Deinandra conjugens* populations.	Continuous	USFWS*, CDFG	Completed (CBI 2018). Determined to be one population and SDMMP developed genetic subgroups to inform augmentation (SDMMP 2021, Figure 4.4-6, 4.4-8)
3	5.5.3	Determine what distances pollinators can travel and how fragmentation affects pollinators' ability to contribute to long distance pollen transfer between populations of *Deinandra conjugens*.	4	USFWS*, CSD, SDC, CCV, CDFG	Not started. General information is available for the orders of insects that potential pollinate DECO.
3	5.6	Continue to develop techniques to germinate and propagate *Deinandra conjugens*.	2	USFWS*, CSD, SDC, CCV, CDFG	Not started A plan was developed for seed collection (SDMMP 2021, Table 4-4.1)
3	6.1	Develop and implement outreach plans to conserve *Deinandra conjugens*.	Continuous	USFWS, CSD*, SDC*, CCV*, CDFG	Not started
3	6.2	Continue to develop informational outreach materials regarding the conservation of *Deinandra conjugens* and its associated habitat, and the greater ecosystem needs (including the interplay of other species) within preserved lands.	Continuous	USFWS*, CSD*, SDC*, CCV*, CDFG*	Not started.
3	7	Enter into dialogue with Mexican governmental and nongovernmental organizations to secure protection for *Deinandra conjugens* in Mexico.	Ongoing	USFWS*, CDFG, NGO	Not started. New information is available on the extent of the species range in Mexico (SDZWA 2022).

[1.] Summary of the Recovery Tasks from the 2004 *Deinandra conjugens* Recovery Plan and whether they have been completed, are in progress, or have not been initiated.

* Indicates responsible lead entity or entities.

CDFG-California Department of Fish and Game
CSD-City of San Diego
CCV-City of Chula Vista
NGO-Nongovernmental Organizations
SDC-San Diego County

FIELD OFFICE APPROVAL

Lead Field Supervisor, Fish and Wildlife Service

☒ Approved

SCOTT SOBIECH

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Scott A. Sobiech
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