Dudleya cymosa ssp. *marcescens*
(Marcescent Dudleya)

5-Year Review:
Summary and Evaluation

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U.S. Fish and Wildlife Service
Ventura Fish and Wildlife Office
Ventura, California

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5-YEAR REVIEW

Dudleya cymosa ssp. *marcescens* (Marcescent Dudleya)

I. GENERAL INFORMATION

Purpose of 5-Year Review:

The U.S. Fish and Wildlife Service (Service) is required by section 4(c)(2) of the Endangered Species Act (Act) to conduct a status review of each listed species at least once every 5 years. The purpose of a 5-year review is to evaluate whether or not the species' status has changed since it was listed (or since the most recent 5-year review). Based on the 5-year review, we recommend whether the species should be removed from the list of endangered and threatened species, be changed in status from endangered to threatened, or be changed in status from threatened to endangered. Our original listing of a species as endangered or threatened is based on the existence of threats attributable to one or more of the five threat factors described in section 4(a)(1) of the Act, and we must consider these same five factors in any subsequent consideration of reclassification or delisting of a species. In the 5-year review, we consider the best available scientific and commercial data on the species, and focus on new information available since the species was listed or last reviewed. If we recommend a change in listing status based on the results of the 5-year review, we must propose to do so through a separate rule-making process defined in the Act that includes public review and comment.

Species Overview:

As summarized in the recovery plan for this species, Recovery Plan for Six Plants from the Mountains Surrounding the Los Angeles Basin (Service 1999), *Dudleya cymosa* ssp. *marcescens* is a succulent, perennial herb in the stonecrop family (Crassulaceae), with a thickened rootstock, and leaves that wither in the summer drought but remain attached to the plant. *Dudleya cymosa* ssp. *marcescens* inhabits faces of volcanic outcrops where sufficient substrate and lichens exist to support the plant's growth. It is currently known from a 24-kilometer (km) (15-mile (mi)) stretch of the Santa Monica Mountains straddling the Ventura and Los Angeles County line in California.

Methodology Used to Complete the Review:

This review was prepared by the Ventura Fish and Wildlife Office (VFWO), following the Region 8 guidance issued in March 2008. We used information from the recovery plan, survey information from experts who have been monitoring various localities of this species, and the California Natural Diversity Database (CNDDB) maintained by the California Department of Fish and Game (CDFG). The recovery plan and personal communications with experts were our primary sources of information used to update the species' status and threats. This 5-year review contains updated information on the species' biology and threats, and an assessment of that information compared to that known at the time of listing or the last 5-year review. We focus on current threats to the species that are attributable to the Act's five listing factors. The review synthesizes all this information to evaluate the listing status of the species and provide an

indication of its progress towards recovery. Finally, based on this synthesis and the threats identified in the five-factor analysis, we recommend a prioritized list of conservation actions to be completed or initiated within the next 5 years.

Contact Information:

Lead Regional Office: Diane Elam, Deputy Division Chief for Listing, Recovery, and Habitat Conservation Planning; and Jenness McBride, Fish and Wildlife Biologist, Region 8, Pacific Southwest; (916) 414-6464.

Lead Field Office: Jenny Marek, Fish and Wildlife Biologist, (805) 644-1766 extension 325; and Connie Rutherford, Listing and Recovery Program Coordinator for Plants; Ventura Fish and Wildlife Office; (805) 644-1766, extension 306.

Federal Register Notice Citation Announcing Initiation of This Review: A notice announcing initiation of the 5-year review of this taxon and the opening of a 60-day period to receive information from the public was published in the Federal Register (FR) on March 5, 2008 (73 FR 11945). The Service received one response collectively regarding all 58 species covered in the notice, which we have considered in preparing this 5-year review.

Listing History:

Original Listing
FR Notice: 62 FR 4172
Date of Final Listing Rule: January 29, 1997
Entity Listed: *Dudleya cymosa* ssp. *marcescens* (subspecies)
Classification: Threatened

Associated Rulemakings: N/A

Review History: N/A

Species' Recovery Priority Number at Start of 5-Year Review: The recovery priority number for *Dudleya cymosa* ssp. *marcescens* is 9 according to the Service's recovery plan for this species, based on a 1-18 ranking system where 1 is the highest-ranked recovery priority and 18 is the lowest (Endangered and Threatened Species Listing and Recovery Priority Guidelines, 48 FR 43098, September 21, 1983). This number indicates that the taxon is a subspecies that faces a moderate degree of threat and has a high potential for recovery.

Recovery Plan or Outline

Name of Plan or Outline: Recovery Plan for Six Plants from the Mountains Surrounding the Los Angeles Basin

Date Issued: September 30, 1999

II. REVIEW ANALYSIS

Application of the 1996 Distinct Population Segment (DPS) Policy:

The Act defines species as including any subspecies of fish or wildlife or plants, and any distinct population segment (DPS) of any species of vertebrate wildlife. This definition limits listing as distinct population segments to vertebrate species of fish and wildlife. Because the species under review is a plant and the DPS policy is not applicable, the application of the DPS policy to the species' listing is not addressed further in this review.

Information on the Species and its Status

Species Biology and Life History

Dudleya cymosa ssp. *marcescens* is a succulent, perennial herb with a thickened rootstock, rosette leaves, and thick flowering stems with corolla that are bright yellow, to yellow with red markings, to bright red (Munz 1974). *Dudleya cymosa* ssp. *marcescens* seeds generally germinate in the winter following the start of the wet season (Dorsey 2007). Riefner and Bowler (1995) hypothesize that the fog-capturing lichen found in the coastal bluffs and cliffs of California may trap *Dudleya* seeds, provide nutrients and water, and may protect young plants from snail and slug herbivory. Flowering generally occurs between May and June and produces fruits with five follicles that split open to release abundant small seeds in late summer or early fall (Skinner and Pavlik 1994, Dorsey 2007). *Dudleya cymosa* ssp. *marcescens* is pollinated by hummingbirds and bees, and produces an abundant amount of small seed. Pollination services to *D. cymosa* ssp. *marcescens* may be less than for other *Dudleya* taxa because they grow on rock faces with no other flowering plants to attract pollinators. The seeds of *D. cymosa* ssp. *marcescens* range from 0.2 to 1.2 millimeters (0.008 to 0.047 inch) in diameter (Wall 2008).

Two *ex situ* seed collection and germination studies have resulted in similar *Dudleya cymosa* ssp. *marcescens* germination rates, finding seedling viability at 48 percent and 43 percent (Fraga and Wall 2006, Dorsey 2007). The germination study by Dorsey (2007) indicated that 86 percent of the seedlings survived transplant and 76 percent of the seedlings that survived went on to flower in the first 6 months. Compared with other rare *Dudleya* taxa found in the Santa Monica Mountains (including *D. parva, D. blochmaniae* ssp. *blochmaniae, D. verityi, D. cymosa* ssp. *agourensis,* and *D. cymosa* ssp. *ovatafolia*), *D. cymosa* ssp. *marcescens* had a relatively low reproductive output and low seed germination that may put it in greater danger of extinction than other rare *Dudleya* taxa (Dorsey 2007).

Dudleya cymosa ssp. *marcescens* gets its subspecies name from the marcescent quality of its leaves, as they wither in the summer but remain attached to the plant. Leaf withering is a physiological response to dry summer conditions, and may not occur if water is perennially available. In greenhouse studies where the species was watered during the summer, *D. cymosa* ssp. *marcescens* retained its leaves indicating that rosettes of *D. cymosa* ssp. *marcescens* are facultatively, not obligately, summer dormant (McCabe et al., in prep. 2008). This flexibility may allow *D. cymosa* ssp. *marcescens* to adapt to changes in precipitation from year to year, and may enhance the species' ability to survive in a changing climate.

Some *Dudleya* taxa are also known to facultatively switch between crassulacean acid metabolism (CAM) and C3 photosynthesis pathways in response to drought conditions. CAM photosynthesis involves the uptake and sequestration of carbon dioxide only at night when less water will be lost through the stomata. During the day when light is available as an energy source, the carbon dioxide collected during the night is fixed into organic carbon. CAM photosynthesis is highly water efficient, but has a low carbon fixation rate due to carbon dioxide storage constraints. During C3 photosynthesis, stomata are open during the day and carbon dioxide is continually fixed into organic carbon. The C3 photosynthesis pathway allows for greater carbon fixation, but is less water efficient than CAM. Carbon isotope studies on *Dudleya cymosa* ssp. *ovatifolia* found that during the development of leaves earlier in the season, when water was more available, the plant was using a C3 pathway. During the development of the inflorescence, as drought conditions were developing, the CAM pathway was being used as a water conservation measure (Thorghton et al. 1977). The ability of some *Dudleya* taxa to facultatively switch between CAM and C3 photosynthesis may allow these species to optimize growth in response to environmental conditions. This flexibility may be particularly beneficial to the species in the face of climate change.

Distribution

Dudleya cymosa ssp. *marcescens* is endemic to the Santa Monica Mountains in California and is known from a 24-km (15-mi) stretch between Hidden Valley and Malibu Creek State Park (Raven et al. 1986). The total area that encompasses all of the known *D. cymosa* ssp. *marcescens* occurrences is approximately 230 square km (88 square mi). As shown in Appendix A, multiple *D. cymosa* ssp. *marcescens* sites are grouped along two watersheds, Little Sycamore Canyon (Element Occurrence (EO) 2, EO 3, and EO 4) and Malibu Creek (EO 5, EO 6, EO 7, Mott Road, and Rock Pool) with all other occurrences scattered between these two locations. The grouping of the plants along the watershed corridor may indicate a dispersal mechanism that is driven by water or short-distance wind dispersal. The seeds of *D. cymosa* ssp. *marcescens* are very small in size and may be easily transported by water, wind, or animals within and outside of the watershed (Wall 2008).

Abundance, Population Trends

According to EO records available through the CNDDB, field surveys from the National Park Service (NPS), and seed collection studies, 13 sites currently or historically supported *Dudleya cymosa* ssp. *marcescens*. Of these 13 sites, 4 are newly documented since the species' listing in 1997. New occurrences were primarily identified by NPS staff and researchers, and in some cases may not be verified as *D. cymosa* ssp. *marcescens*, or may ultimately be incorporated into existing occurrences. They are included here to provide a complete set of all potential occurrences. One occurrence listed in the CNDDB database, EO 9 Mulholland/Yerba Buena, was not included in the 1999 recovery plan, and has not been further evaluated to confirm the occurrence (Sagar 2008a, McCabe 2008). EO 9 is treated in this status review as a potential historic or current occurrence. The estimated number of individuals at each occurrence ranges between 70 and 4,100 plants (Table 1). The most recent surveys, completed in 2003 by NPS and in 2005 by Dorsey, indicate that the total number of individuals of *D. cymosa* ssp. *marcescens* throughout its range is approximately 12,000[1].

[1] Total estimated number of individuals is based on the most recent quantified estimates from each occurrence available. Occurrences where the number of plants were not estimated are not included.

Although abundance data is limited to only a few records per site, the data suggests that, as of the most recent surveys, the occurrences that supported large numbers of individuals in the past continue to support stable or increasing numbers of individuals. These occurrences include EO 3 Yerba Buena/Cotharin and EO 8 Hidden Valley. Both occurrences in Malibu Creek State Park (EO 6 and EO 7) supported 1,000 individuals or more in 2003, and two potentially new occurrences, Mott Road and a site across from Century Lake, were found in 2005 adjacent to EO 6 and EO 7. EO 1, Seminole Hot Springs, was reported to have fewer than 50 plants in 1982 but supported approximately 100 individuals in 2005 (CNDDB 2008, Dorsey 2005). One occurrence, EO 2 Yerba Buena Road, was known to support 9 individuals in 1978 and none were observed in 2003 (CNDDB 2008, NPS 2003). Similarly, *D. cymosa* ssp. *marcescens* was observed at EO 4, Little Sycamore Creek, in 1932 but was not found in 2003 (CNDDB 2008, NPS 2003). Trends in the numbers of individuals at all other sites cannot be determined due to a lack of monitoring information.

Table 1. Population Records for *Dudleya cymosa* ssp. *marcescens* from CNDDB (2008), Dorsey (2005), and NPS (2003).

EO#	Name	CNDDB Current Trend	Year Collected/ Observed	Pop Size (Year surveyed)	Reference	Site Manager/ Owner
1	Seminole Hot Springs	Unknown	1982	Fewer than 50 (1982) 100 (2005)	CNDDB 2008 Dorsey 2005	Private
2	Yerba Buena Road	Unknown	1978	9 (1978) Not observed (2003)	CNDDB 2008 NPS 2003	Private
3	Yerba Buena/Cotharin	Unknown	1974	Abundant (1974) 1,000+ (1994) 1,500 (2003) 4,100 (2006)	CNDDB 2008 NPS 2003 Fraga & Wall 2006	Private
4	Yerba Buena Road/ Little Sycamore Creek	Unknown	1932	Observed (1932) Not Observed (2003)	CNDDB 2008 NPS 2003	Private
5	Salvation Army Camp	Unknown	1979	Observed (1979)	CNDDB 2008	Private
Unassigned	Mott Road, Malibu Creek State Park	Unknown	2003	300 (2003)	NPS 2003	State Parks
6	Rock Pool, Malibu Creek State Park	Unknown	1981	Fewer than 50 (1981) Observed (1984) 1,400 (2003)	CNDDB 2008 NPS 2003	State Parks
Unassigned	Across from Century Lake, Malibu State Park	Unknown	2005	Hundreds (2005)	Dorsey 2005	State Parks
7	Udell Gorge, Malibu Creek State Park	Unknown	1984	Observed (1984) 1,000 (2003)	CNDDB 2008 NPS 2003	State Parks
8	Hidden Valley	Unknown	1984	More than 100 (1984) 4,000 (2003)	CNDDB 2008 NPS 2003	Private
9	Mulholland and Yerba Buena Road	Unkonwn	1993	100+ (1993)	CNDDB 2008	Private
Unassigned	Circle-X Grotto	Unknown	2003	1,000 (2003)	NPS 2003	NPS
Unassigned	Trancas Canyon	Unknown	2003	70 (2003) 100 (2003)	NPS 2003	NPS

The common name for the genus *Dudleya* is "live-forever" and indicates that one characteristic that these species share is a long lifespan. The lifespan of wild *Dudleya cymosa* ssp. *marcescens* has not been documented, but *Dudleya* individuals have been known to live in cultivation for more than 20 years. The seeds of *D. cymosa* ssp. *marcescens* are thought to be long-lived as well. In cold storage, Dudleya seeds have been shown to germinate after 15 to 20 years of storage; seed longevity in the wild is unknown (Wall 2008). Because the species is likely to have a long lifespan, determining the stability of the known occurrences is difficult without sufficient demographic data to indicate whether *D. cymosa* ssp. *marcescens* occurrences are populated with multiple age classes. The documentation of multiple age classes would indicate that the species is regularly reproducing, whereas finding a single age class would indicate that the species may not be consistently reproducing and therefore may not be stable at a given location. Surveys conducted in 2003 by the NPS documented limited demographic information by assuming age classes based on the observation of flowering *D. cymosa* ssp. *marcescens.* A more robust survey of *D. cymosa* ssp. *marcescens* demographics is necessary to understand the stability of each occurrence.

Habitat or Ecosystem Conditions (e.g., amount and suitability).
On a broad scale, suitable habitat for *Dudleya cymosa* ssp. *marcescens* is generally located on the lower reaches of volcanic rock outcrops adjacent to streams, chaparral, and coast live oak (*Quercus agrifolia*) woodland (CNDDB 2008, NPS 2003). In most locations, the topographic relief has prevented deep soil formation; therefore, this species may be the only flowering plant occurring in a microhabitat that is otherwise dominated by mosses, lichens, and ferns (CNDDB 2008). The locations of volcanic outcrops within the Santa Monica Mountains that are known to host this species are shown in Figure 1 of Appendix A. The mosses and lichens may play a crucial role in trapping *D. cymosa* ssp. *marcescens* seeds and allowing them to germinate and establish on the volcanic outcrops (Riefner and Bowler 1995, Riefner and Wishner 2000).

Changes in Taxonomic Classification or Nomenclature.
No changes in taxonomic classification or nomenclature have occurred since the time of listing.

Genetics
No new studies concerning the genetics of this taxon have been conducted since the time of listing.

Species-specific Research and/or Grant-supported Activities
Recent studies focusing on *Dudleya cymosa* ssp. *marcescens* have been conducted by Naomi Fraga and Michael Wall at Rancho Santa Ana Botanic Garden, and studies are currently being conducted by Ann Dorsey at California State University, Northridge, and by the NPS. Fraga and Wall recently collected seed and ran germination and viability studies on federally listed species that occur on California State Parks' property. The effort was intended to secure conservation seed bank collections for sensitive species, and has been successfully completed (Wall 2008). Dorsey is studying multiple *Dudleya* species in the Santa Monica Mountains and has compared similarities and differences in morphology, habitat, range, and reproduction between the species. Dorsey is also investigating seed germination and survival rates to extrapolate the relative reproductive effort and success of various rare *Dudleya* taxa in the Santa Monica Mountains (Dorsey 2008). In 2009 NPS began an annual monitoring program that will track the number of

individuals, age class, substrate health, and threats for select *D. cymosa* ssp. *marcescens* occurrences including Mott Road at Malibu Creek State Park and Seminole Hot Springs.

Five-Factor Analysis

FACTOR A: Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range

In the final rule listing *Dudleya cymosa* ssp. m*arcescens*, we noted that the species' habitat, rocky outcrops, is often used for rock climbing and rappelling (Service 1997). These activities have the potential to destroy the moss substrate that the species depends on and can tear out individual plants. Rock climbing and rappelling may occur on both public and private land where *D. cymosa* ssp. *marcescens* occurs. Popular rock climbing areas located in the vicinity of known *D. cymosa* ssp. m*arcescens* occurrences include Planet of the Apes Wall, Ghetto Wall, Echo Cliffs, and Century Lake Canyon (The Mountain Project 2008, Rockclimbing.com 2008).

Figure 1. Lichens and mosses appear to have been disturbed by informal climbing at the Mott Road site within Malibu Creek State Park (J. Marek, pers. obs. 2009).

Malibu Creek State Park staff have indicated that although *D. cymosa* ssp. *marcescens* is located in areas adjacent to popular climbing sites within Malibu Creek State Park, established climbing areas and the species' occurrences are spatially separated (Goode 2008). During a site visit on May 26, 2009 Service staff observed no signs of climbing disturbance to the plants across from Century Lake, in Malibu Creek State Park, which is adjacent to an established climbing area (J. Marek, Service Biologist, pers. obs. 2009). During the site visit, substrate disturbance was observed at the Mott Road site within Malibu Creek State Park, and likely occurred from informal climbing or boulder hopping (Figure 1). An unknown number of individual plants were damaged or destroyed by the disturbance (Figure 2). This was likely an isolated event because the rock face does not appear to be appealing to climbers and would not likely attract repeated attempts. NPS staff will continue to monitor this site annually for the next five years, and will note any additional damage (NPS in prep. 2009). The condition of *Dudleya cymosa* ssp. *marcescens* at other climbing sites within Malibu Creek State Park

Figure 2. An uprooted *Dudleya cymosa* ssp. *marcescens* at the Mott Road site within Malibu Creek State Park (J. Marek, pers. obs. 2009).

was not observed during the May 26, 2009 site visit. NPS representatives have indicated that their law enforcement staff generally have a good relationship with major climbing groups that use NPS lands, and that many climbers have agreed not to climb on areas that are vegetated (Sagar 2008b). Although large climbing groups may be aware of the sensitive species that grow on climbing walls, individual climbers may not.

On April 27, 2009 the Service was notified by NPS staff that large swaths of moss that support *Dudleya cymosa* ssp. *marcescens* had been damaged at the Seminole Hot Springs occurrence (Sagar 2009). The moss appeared to be scraped away from the rock face to form pictures and initials (Figure 3). An unknown number of individual plants have been damaged or destroyed by the disturbance (Figure 4). The site appears to be used as a local social gathering place, and will likely suffer recurring damage if some type of protective action is not taken (e.g. closing the site to public access, posting signage, etc.).

Figure 3. Damage to moss that supports *Dudleya cymosa* ssp. *marcescens* at Seminole Hot Springs (J. Marek, pers. obs. 2009).

In the rule listing the species, we also discussed that occurrences are located on both public and private lands, and that individuals of *Dudleya cymosa* ssp. m*arcescens* on private lands may be threatened by development. Seven of the known occurrences are on private lands and six are on public lands. Sites that occur on public lands are protected from development, but may be threatened by recreational activities as described above. One occurrence on private land, Seminole Hot Springs, is owned by the Mountains Restoration Trust, a non-profit land trust dedicated to preserving natural land in the Santa Monica Mountains. This site is protected from development, but is threatened by recreational activities as demonstrated by the damage to the moss substrate observed in 2009. For the other six occurrences on private lands, local zoning designations can provide some information about the potential for development at each site (Appendix B). Private lands that support *D. cymosa* ssp. m*arcescens* individuals are primarily zoned for open space or agriculture, with certain parcels in Ventura County falling under the Santa Monica Mountains Overlay Zone, which provides protections for sensitive species including *D. cymosa* ssp. m*arcescens*. Details of these zoning classifications are listed in Appendix B.

Figure 4. A *Dudleya cymosa* ssp. *marcescens* individual that may be affected by damage to the moss at Seminole Hot Springs (J. Marek, pers. obs. 2009).

Zoning of private lands in locations where *Dudleya cymosa* ssp. *marcescens* occurs generally permits the construction of houses, barns, and other residential structures on 10-acre or 40-acre parcels or conversion to agriculture. Because *D. cymosa* ssp. m*arcescens* grows on rock faces, direct destruction would occur only if rock outcrops are removed, and it is more likely that development would impact *D. cymosa* ssp. m*arcescens* by disturbing or destroying the vegetation around individuals such that the habitat for *D. cymosa* ssp. m*arcescens* is no longer suitable for the species.

In summary, threats to the habitat of *Dudleya cymosa* ssp. m*arcescens* remain similar to at the time of listing, although the threat from rock climbing in established areas may be less significant than was thought at the time of listing and the threat from other recreational activities (e.g., damage from informal climbing, boulder hopping, and substrate removal at gathering sites) may be more significant than was thought at the time of listing. Threats primarily include potential modification or destruction from recreation, rock climbing, and development. Zoning in areas where *D. cymosa* ssp. *marcescens* occurs generally allows for construction of various structures and agriculture facilities; however, the impact to the species from these land uses, if implemented, is uncertain.

FACTOR B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

At the time of listing in 1997, we discussed that species of *Dudleya* are collected by professional horticulturalists as well as amateur collectors and gardeners (Service 1997). We believe that collection still may constitute a threat to the species. A special issue of the Cactus and Succulent Journal was published by the Cactus and Succulent Society of America (CSSA) that focused on *Dudleya* (CSSA 2004). There was a confirmed report of vandalism of chalk dudleya (*D. pulverulenta*) near a public access location in Topanga Canyon in 1999, illustrating that collection of *Dudleya* species continues to be a threat to members of this genus (Farris 1999). On May 26, 2009, Service and NPS staff observed soil disturbance and a noted lack of *Dudleya parva* [*Dudleya abramsii* ssp. *parva*] at Wildwood Regional Park in Thousand Oaks, California, in locations where individuals of the species were seen earlier in the year (Figure 5). Service and NPS biologists hypothesize that the plants may have been targeted by a collector due to the precise nature of the soil disturbance and the observation of *Dudleya parva* root fragments in the disturbance area. Although we do not have specific reports of vandalism for *D. cymosa* ssp. *marcescens*, we believe that, due to the accessibility of certain populations to the public, collection still constitutes a threat to the species.

Figure 5. Soil disturbance and root fragments of *Dudleya parva* at Wildwood Regional Park, in a location where the species was previously known to occur (J. Marek, pers. obs. 2009).

FACTOR C: Disease or Predation

Disease or predation was not discussed as a threat at the time of listing in 1997, and is not considered a threat at this time.

FACTOR D: Inadequacy of Existing Regulatory Mechanisms

In the rule listing the species (62 FR 4172) and in the recovery plan (Service 1999), we discussed that regulatory mechanisms with potential to protect *Dudleya cymosa* ssp. *marcescens* included: (1) National Park Service conservation and management policies; (2) the California Environmental Quality Act (CEQA); (3) California Department of Parks and Recreation (State Parks) land use policies; (4) California Endangered Species Act; and (5) local land use laws, regulations, and policies. The listing rule (62 FR 4172) and recovery plan (Service 1999) provides an analyses of the level of protection that was anticipated from those regulatory mechanisms. This analysis appears to remain currently valid.

(1) National Park Service conservation and management policies: *Dudleya cymosa* ssp. *marcescens* occurs on Federal lands owned and managed by the Santa Monica Mountains National Recreation Area (SMMNRA). The specific policies that address the conservation and management of SMMNRA lands are contained in Title 36 of the Code of Federal Regulations, Volume 1, Chapter 1, Parts 1-5 and the Santa Monica Mountains National Recreation Area Superintendent's Compendium (NPS 2007b). Policies that are protective of *D. cymosa* ssp. *marcescens* include the prohibition of hiking and climbing in areas other than NPS-designated trails; the prohibition of collecting plants or wildlife without a permit; and the prohibition of scraping, chiseling, and/or brushing the natural features of climbing rocks to avoid damage to flora (NPS 2007b). NPS staff at SMMNRA are familiar with *D. cymosa* ssp. *marcescens* occurrences both within and outside of NPS property and have surveyed many of the populations. NPS staff have also assisted researchers with studies focusing on the rare *Dudleya* species and are regularly in communication with species experts. NPS law enforcement routinely patrols NPS land in the Santa Monica Mountains, although the area they cover is large and vandalism and rock climbing impacts may go unnoticed (Sagar 2008b).

(2) California Environmental Quality Act (CEQA): CEQA requires review of any project that is undertaken, funded, or permitted by the State or a local governmental agency. If significant effects are identified, the lead agency has the option of requiring mitigation through changes in the project or to decide that overriding considerations make mitigation infeasible (CEQA section 21002). Protection of listed species through CEQA is, therefore, dependent upon the discretion of the lead agency involved. However, if there are no feasible mitigation measures, and if the lead agency believes the benefits of the project outweigh the environmental risks, it may approve a project by making a statement of overriding considerations. If the lead agency is interested in having the project proceed, it is likely to approve the report or make the statement of overriding considerations, even if listed species are affected. At the time of listing, we noted in the FR that local lead agencies that are responsible for enforcing the regulations of CEQA have made

determinations that have or will negatively impact *Dudleya parva*, and that a similar determination could impact *Dudleya cymosa* ssp. *marcescens*.

(3) California Department of Parks and Recreation: The California Department of Parks and Recreation (State Parks) owns and manages Malibu Creek State Park, which supports *Dudleya cymosa* ssp. *marcescens.* The mission of State Parks is to, "provide for the health, inspiration and education of the people of California by helping to preserve the state's extraordinary biological diversity, protecting its most valued natural and cultural resources, and creating opportunities for high-quality outdoor recreation" (California Park and Recreation Commission 2007). In practice, State Parks does not currently have the resources to monitor and actively protect *D. cymosa* ssp. *marcescens.* State Parks staff are aware that *D. cymosa* ssp. *marcescens* may be threatened by rock climbing at Malibu Creek State Park, and have anecdotally indicated that rock climbing is not impacting the species (Goode 2008). However, without regular monitoring of the sites, the impacts associated with recreational activities are uncertain.

(4) California Endangered Species Act: *Dudleya cymosa* ssp. *marcescens* is currently State listed as "rare;" however, rare plants do not have protections under the California Endangered Species Act (CDFG 2008). In 1977, the Native Plant Protection Act was passed and created the status "endangered" or "rare" for native plants, and protected plants with these classifications from take. In 1984 the California Endangered Species Act was passed and created the categories of "threatened" and "endangered." All animals previously classified as rare were converted to "threatened" status, but the status of rare plants was not changed (CDFG 2008, Langner 2008). Therefore, plants that are classified as rare are not currently protected from take under the California Endangered Species Act.

(5) Local land use laws, regulations, and policies:

> County of Ventura
> The county has a zoning overlay for the Santa Monica Mountains intended to provide specific protection measures for the several unique, rare, or endangered plant and animal species in the area. The zoning overlay prohibits development unless there will be no significant impacts to sensitive species and all unique species, including *Dudleya cymosa* ssp. *marcescens*, are protected. This zoning overlay does not apply to all parcels on which *D. cymosa* ssp. *marcescens* occurs.
>
> County of Los Angeles
> The county has provisions for designating certain sites as Significant Ecological Areas; however, such designations are not permanent and are on private land, and therefore are of limited importance as a conservation tool.

In summary, recreational threats may potentially be evaluated and controlled by California State Parks and NPS, and development threats may be addressed through CEQA and local land use regulations. The California Endangered Species Act provides no protections for *Dudleya cymosa* ssp. *marcescens.* Although State Parks and NPS are charged with preserving rare species, resource limitations often preclude adequate monitoring that would identify impacts from recreational activities. CEQA and local land use regulations provide discretionary

protections for the species based on current management direction, but do not guarantee

protection for the species. Therefore, we continue to believe other laws and regulations have limited ability to protect the species in the absence of the Endangered Species Act.

FACTOR E: Other Natural or Manmade Factors Affecting Its Continued Existence

At the time of listing *Dudleya cymosa* ssp. m*arcescens* in 1997, we discussed that fire can be a natural or human caused factor affecting *D. cymosa* ssp. *marcescens* (Service 1997). The ecosystems of the Santa Monica Mountains have evolved with periodic lightning-caused fires that were generally small in size and intensity, but occurred at frequent intervals (NPS 2007b). With the expansion of human settlement, it has been suggested that large fires are the result of effective suppression of small fires (NPS 2007b). Fire has been observed to reduce moss substrate that *D. cymosa* ssp. *marcescens* requires (Dedero 1992). Furthermore, it may be assumed that large fires pose a greater threat to *D. cymosa* ssp. *marcescens* because large fires may have a greater flame height and burn temperature that may impact the rocky outcrops that might otherwise be unaffected by small fires with lower flame heights and burn temperatures. Large fires may also burn through the entire range of the species whereas small fires would cover less area. The NPS's Santa Monica Mountains National Recreation Area Fire Management Plan states that fire suppression activities will avoid disturbance of threatened and endangered species and their habitat, and NPS staff members that are familiar with sensitive resources will be present during all extended suppression activities to advise fire personnel of the location of sensitive resources (NPS 2007a).

A factor that was not considered at the time of listing is climate change. Current climate change predictions for terrestrial areas in the northern hemisphere indicate warmer air temperatures, more intense precipitation events, and increased summer continental drying (Field et al. 1999, Hayhoe et al. 2004, Cayan et al. 2005, Intergovernmental Panel on Climate Change 2007). Recently, the potential impacts of climate change on the flora of California were discussed by Loarie et al. (2008). Based on modeling, they predicted that species' distributions will shift in response to climate change, and that species will "move" or disperse to higher elevations and northward, depending on the ability of each species to do so. Species diversity may also shift in response to these changes with a general trend of increasing diversity towards the coast and northwards with these areas becoming potential future refugia. The Santa Monica Mountains region is expected to increase in diversity, becoming one of these potential future refugia (Loarie et al. 2008). These increases in species diversity in the refugia, due to climate change, have the potential to result "…in new species mixes, with consequent novel patterns of competition and other biotic interactions…" to the species present (Loarie et al. 2008) with unknown consequences to the species present.

We recognize that climate change is an important issue with potential effects to listed species and their habitats. While we lack adequate information to make specific and accurate predictions regarding how climate change, in combination with other factors such as small population size, will affect *Dudleya cymosa* ssp. *marcescens*, small-ranged species, such as *D. cymosa* ssp. *marcescens*, are generally more vulnerable to extinction due to these changing conditions (Pimm and Raven 2000, Loarie et al. 2008). Some *Dudleya* taxa have evolved characteristics such as

facultative leaf withering (McCabe et al. in prep. 2008) and switching between CAM and C3 photosynthesis pathways (Thorghton et al. 1977), which allow them to live in water-limited environments and adapt to climate fluctuations. These characteristics may benefit the species in the face of a changing climate.

In summary, other natural or manmade threats to *Dudleya cymosa* ssp. *marcescens* are generally the same as they were at the time of the listing in 1997, with the addition of concerns regarding the impact of climate change on this species. Threats primarily include destruction from fire and climate change.

III. RECOVERY CRITERIA

Recovery plans provide guidance to the Service, States, and other partners and interested parties on ways to minimize threats to listed species, and on criteria that may be used to determine when recovery goals are achieved. There are many paths to accomplishing the recovery of a species and recovery may be achieved without fully meeting all recovery plan criteria. For example, one or more criteria may have been exceeded while other criteria may not have been accomplished. In that instance, we may determine that, over all, the threats have been minimized sufficiently, and the species is robust enough, to downlist or delist the species. In other cases, new recovery approaches and/or opportunities unknown at the time the recovery plan was finalized may be more appropriate ways to achieve recovery. Likewise, new information may change the extent that criteria need to be met for recognizing recovery of the species. Overall, recovery is a dynamic process requiring adaptive management, and assessing a species' degree of recovery is likewise an adaptive process that may, or may not, fully follow the guidance provided in a recovery plan. We focus our evaluation of species status in this 5-year review on progress that has been made toward recovery since the species was listed (or since the most recent 5-year review) by eliminating or reducing the threats discussed in the five-factor analysis. In that context, progress towards fulfilling recovery criteria serves to indicate the extent to which threat factors have been reduced or eliminated.

The recovery plan indicates that delisting for *Dudleya cymosa* ssp. *marcescens* can be considered when the following criteria have been achieved:

1. All the current sites (including seedbanks) are fully protected and managed with the primary intention of preserving the populations in perpetuity (addresses Listing Factors A and E).

This criterion is relevant and up-to-date. At the time of listing *Dudleya cymosa* ssp. m*arcescens* in 1997, nine occurrences were known, including one unverified occurrence (EO 9). Of those nine occurrences, two (EO 6 and EO7) are found on public land and may be protected and managed by State Parks. State Parks staff are aware that climbing is a potential threat to *D. cymosa* ssp. m*arcescens*, and have indicated that climbing activities are not impacting the occurrences on State Parks land (Goode 2008). However, State Parks does not currently have the resources to routinely monitor and actively protect *D. cymosa* ssp. *marcescens*. The remaining seven occurrences are found on private lands. Three of these, EO 2, EO 3, and EO 4 are protected from development by the County of Ventura's Santa Monica Mountains Overlay Zone classification that stipulates the prohibition of development unless all unique vegetation

(including *D. cymosa* ssp. m*arcescens*) is preserved. Although these occurrences may be protected from development, they may still be impacted by rock climbing and other recreational activities. These sites appear to be less popular for recreational uses than publicly owned sites; however, due to lack of monitoring, impacts to the species at these sites are unclear. One occurrence on private land (EO 1) is owned by the Mountains Restoration Trust, and is protected from development, but is being impacted by recreation. The remaining three occurrences that were known at the time of listing, EO 5, EO 8, and EO 9, are not protected and managed, although they do not appear to be located adjacent to established rock climbing areas, and zoning designations restrict land use at these sites to agricultural and open space uses.

Four new occurrences of *Dudleya cymosa* ssp. *marcescens* have been found on State Parks and NPS property since the taxon's listing in 1997, and are therefore protected from development, but may be threatened by recreational activities, as was observed at the Mott Road occurrence during a site visit on May 26, 2009 (J. Marek, pers. obs. 2009). As discussed above, State Parks staff are not aware of any rock climbing activities, at established rock climbing sites, that are impacting the species in these areas, although resource constraints preclude routine monitoring. NPS law enforcement routinely patrols climbing areas and works with rock climbers to avoid impacts to sensitive species (Sagar 2008b). Individual climbers that are unaware of the sensitivity of vegetation growing on rock faces may still damage or destroy *D. cymosa* ssp. *marcescens* individuals or their habitat. This criterion has been partially met.

2. All the current sites (including seedbanks) are shown to be self-sustaining over a minimum of 10 years (addresses Listing Factors A and E).

This criterion is relevant and up-to-date. Seven of the nine *Dudleya cymosa* ssp. *marcescens* sites that were identified at the time of listing have been surveyed more than one time. Of these seven sites, four have quantifiable information available regarding the number of individuals at the site, with three sites showing an increase in number of individuals and one site declining from nine individuals in 1978 to none observed in 2003 (CNDDB 2008, NPS 2003). Subsequent to the taxon's listing in 1997, 4 additional occurrences have been reported, expanding the total number of sites to 13, although some of these occurrences are unverified and some may overlap with existing occurrences. From the most recent survey data available, the range-wide population of *D. cymosa* ssp. *marcescens* was estimated at 12,000 individuals in 2003. Although many of the sites that support *D. cymosa* ssp. *marcescens* appear to be maintaining or increasing current populations, the lack of survey data at all known locations precludes the determination of population trends at all sites. Furthermore, the lack of demographic data at all sites precludes the determination of population stability. Therefore, this criterion has not been met. However, if a robust population and demographic study is conducted for all known sites, information from the study may indicate that populations appear to be self-sustaining, thereby fulfilling the criterion.

IV. SYNTHESIS

The status of *Dudleya cymosa* ssp. *marcescens* has not changed substantially since the time of listing in 1997. Although additional occurrences have been identified and many sites are showing stable or increasing population trends, additional population and demographic studies need to be conducted to determine self-sufficiency for all occurrences. Rock climbing at

established areas in the Santa Monica Mountains may be less of a threat to *D. cymosa* ssp. *marcescens* than was thought at the time of listing, however informal rock climbing and boulder hopping have resulted in the destruction of plants and damage to substrate at one site, and another site has been impacted by visitors carving their initials or pictures into substrate that supports the species. Recreational activities at established rock climbing areas within Malibu Creek State Park do not appear to be impacting the nearby occurrences of *D. cymosa* ssp. *marcescens*, and NPS staff continue to work with climbing groups to avoid impacts to the species on their property. With 7 of the 13 sites occurring on private lands, collaboration with landowners and local permitting agencies should occur in order to protect *D. cymosa* ssp. *marcescens* on private lands, particularly in cases where zoning is not protective of the species. Because of the current uncertainty in population dynamics and demographics, recent destruction of plants and degradation of habitat at two occurrences, and the small isolated nature of the populations, we conclude that this taxon continues to be likely to become endangered in the foreseeable future and still meets the definition of threatened; therefore, no status change is recommended at this time.

V. RESULTS

Recommended Classification:

_____ Downlist to Threatened
_____ Uplist to Endangered
_____ Delist (indicate reasons for delisting per 50 CFR 424.11):
____ *Extinction*
____ *Recovery*
____ *Original data for classification in error*
_X_ No Change

New Recovery Priority Number and Brief Rationale: No change.

VI. RECOMMENDATIONS FOR FUTURE ACTIONS

1. Establish a monitoring strategy to understand the population and demographic dynamics of *Dudleya cymosa* ssp. *marcescens*. The minimal survey data that is available indicates that many of the populations may be stable or increasing. However, without population data at all sites, abundance trends cannot be determined; without demographic data, population stability cannot be presumed. At a minimum, all known occurrences should be surveyed for abundance and demographics. If survey results indicate that populations are stable or increasing, and all occurrences have multiple age classes, indicating regular recruitment, the species may be considered to be self-sustaining. If survey results indicate that populations are declining or demographics show a single age class, further monitoring will be required to determine population trends.

2. Work with the National Park Service and California Department of Parks and Recreation to identify *Dudleya cymosa* ssp. *marcescens* occurrences on public lands that may be degraded by recreational activities such as climbing, and conduct a study to clearly identify impacts to

the species caused by recreational activities. If impacts are identified, install fencing, signage, or other mechanisms to eliminate threats to the plants and their habitat.

3. Work with rock climbing leaders, organizations, and websites to make them aware of the sensitive species that may occur in the vicinity of their climbing areas. Explore the possibility of establishing "best climbing practices," such as avoiding vegetation on rock faces, and not establishing new climbing sites on rock faces that are vegetated.

4. Work with the Mountains Restoration Trust and other partners to reduce impacts to the individuals and habitat at Seminole Hot Springs by installing signage, installing fencing, closing the area to visitors, or using other means to eliminate recreational threats.

5. Work with private landowners at locations where zoning may permit development to raise awareness of the species. Cooperation with landowners is crucial to monitoring and protecting *Dudleya cymosa* ssp. *marcescens* occurrences on private lands.

6. Work with Ventura County and Los Angeles County to educate them about *Dudleya cymosa* ssp. *marcescens*, so that when issuing development permits the counties are able to identify developments that may impact the species and encourage measures that would protect the species.

7. Survey previously uninvestigated areas with potentially suitable habitat within and adjacent to the known range of *Dudleya cymosa* ssp. *marcescens* to determine if habitat and individuals are present.

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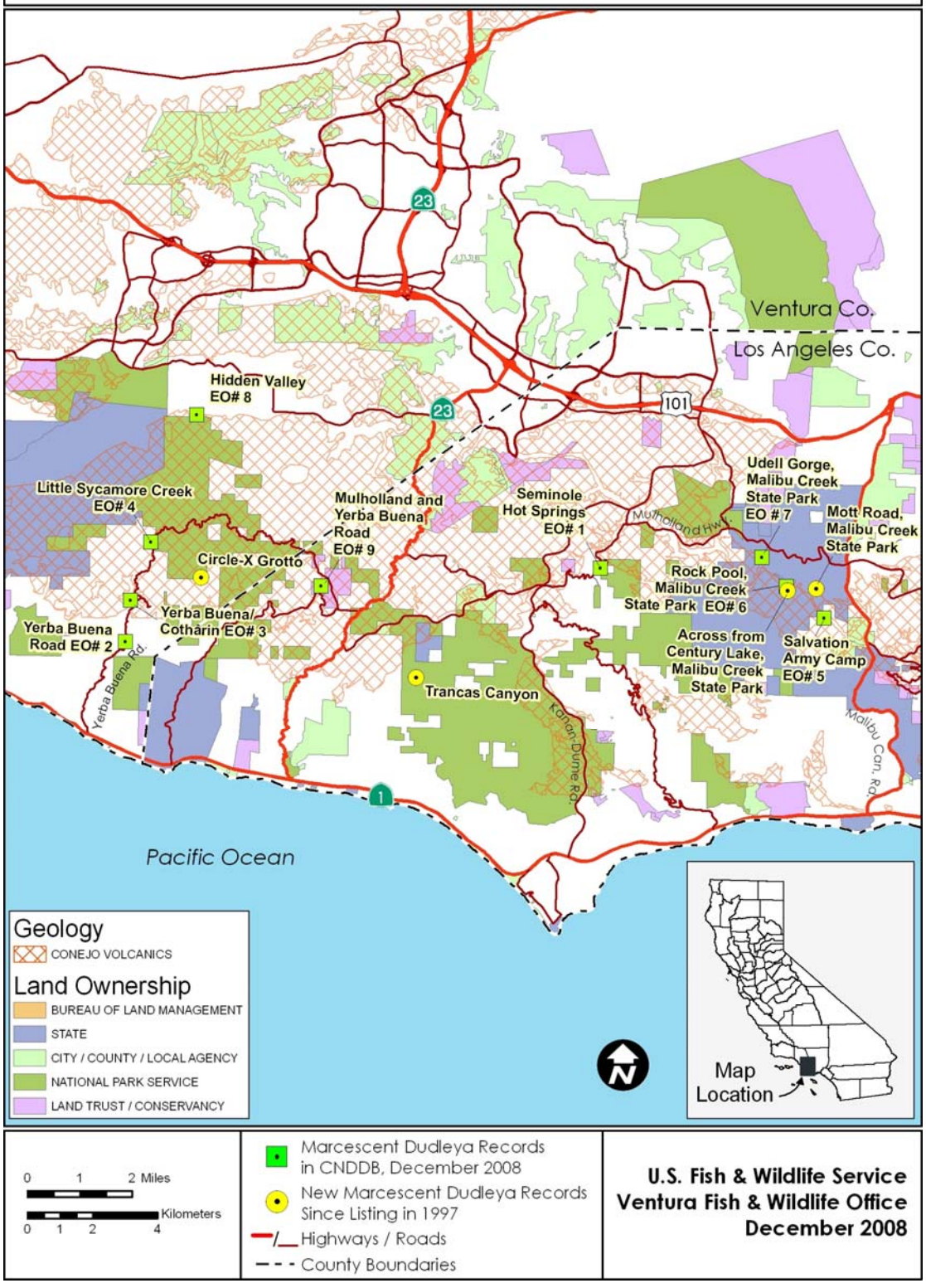
Appendix A. Location Map

Figure 1. Distribution of *Dudleya cymosa* ssp. *marcescens* (Marcescent Dudleya)



Appendix B. Zoning Information

Table A. Zoning information for each *Dudleya cymosa* ssp. *marcescens* occurrence.

EO#	Location	# of individuals	year	Zoning
1	Seminole Hot Springs	Less than 50	1982	A-1-10; light agriculture
2	Yerba Buena Road	4	1978	COS-10 ac-sdf/M; Coastal Open Space
		0	2003	
3	Yerba Buena/ Cotharin	100	1974	COS-10 ac-sdf/M; Coastal Open Space
		1,500	2003	CRE-40 ac/M
4	Little Sycamore Canyon	Observed	1932	COS-10 ac-sdf/M; Coastal Open Space
		Not found	2003	
5	Salvation Army Camp	Observed	1979	A-1-1; light Agriculture
Unassigned	Mott Road, Malibu Creek State Park	300	2003	R-R 10; Resort and Recreational
6	Rock Pool, Malibu Creek State Park	Less than 50	1981	R-R 10; Resort and Recreational
	Rock Pool, Malibu Creek State Park	1,400	2003	
Unassigned	Across from Century Lake	Hundreds	2005	R-R 10; Resort and Recreational
7	Udell Gorge, Malibu Creek State Park	Observed	1984	O-S; Open Space
	Udell Gorge, Malibu Creek State Park	1,000	2003	
8	Hidden Valley	Less than 100	1984	AE-40 ac; Agricultural Exclusive
				OS-40 ac; Open Space
				OS-40 ac; Open Space
		4,000	2003	OS-40 ac; Open Space
				OS-160 ac; Open Space
				AE-40 ac; Agricultural Exclusive
9	Mulholland and Yerba Buena Road	More than 100	1993	A-1-1; Light Agriculture
Unassigned	Circle-X grotto	1,000	2003	COS-10 ac-sdf/M; Coastal Open Space
Unassigned	Trancas Canyon	70	2003	A-1-1; Light Agriculture
		100		

Coastal Open Space (COS) - The purpose of this Ventura County coastal zone is to provide for the preservation, maintenance, and enhancement of natural and recreational resources in the coastal areas of the County while allowing reasonable and compatible uses of the land. Compatible uses that may or may not require a permit include agriculture and one single-family home per lot (Ventura County Planning Division (VCPD) 2008a).

Coastal Rural Exclusive (C-R-E) Zone - The purpose of this Ventura County coastal zone is to provide for residential areas with semirural atmosphere, but exclude agricultural uses to a great extent and concentrate on residential uses (VCPD 2008a).

Santa Monica Mountains (M) Overlay Zone – This Ventura County coastal zone overlay indicates that these parcels are in the Santa Monica Mountains, a unique coastal resource of statewide and national significance. The purpose of this overlay zone is to provide specific protective measures by disallowing development permits unless specific provisions are met. Two provisions that apply to *Dudleya cymosa* ssp. *marcescens* include preserving all unique

vegetation (including *D. cymosa* ssp. *marcescens*) and avoiding adverse impacts to environmentally sensitive habitats (VCPD 2008a).

Agricultural Exclusive (AE) Zone - The purpose of this Ventura County non-coastal zone is to preserve and protect commercial agricultural lands as a limited and irreplaceable resource, to preserve and maintain agriculture as a major industry in Ventura County and to protect these areas from the encroachment of nonrelated uses which, by their nature, would have detrimental effects upon the agriculture industry (VCPD 2008b).

Open Space (OS) Zone - The purpose of this Ventura County non-coastal zone is to provide for the conservation of renewable and nonrenewable natural resources, to preserve and enhance environmental quality and to provide for the retention of the maximum number of future land use options while allowing reasonable and compatible uses on open lands in the County which have not been altered to any great extent by human activities. Some of the reasonable uses that may or may not require a permit include single-family dwellings, mobile homes, farmworker housing complexes, renewable energy production, mineral resource development, recreational facilities, and water production or storage (VCPD 2008b)

Light Agriculture (A-1) Zone – This Los Angeles County zone allows single-family residences, crops, greenhouses, and auxiliary structures (Los Angeles County Department of Regional Planning 2007a and 2008).

Open Space (O-S) Zone – This Los Angeles County zone allows campgrounds, crops, grazing, and resource management (Los Angeles County Department of Regional Planning 2007b and 2008).

Resort and Recreational (R-R) Zone – This Los Angeles County zone allows recreation, amusement, and agricultural uses (Los Angeles County Department of Regional Planning 2007b and 2008).

U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Dudleya cymosa* ssp. *marcescens* (Marcescent dudleya)

Current Classification: Threatened

Recommendation Resulting from the 5-Year Review:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
__X__ No change needed

Review Conducted By: Jenny Marek

FIELD OFFICE APPROVAL:

Field Supervisor, U.S. Fish and Wildlife Service

Approve Diane L Noble Date 8/17/09