

# Recovery Plan for Six Plants from the Mountains Surrounding the Los Angeles Basin

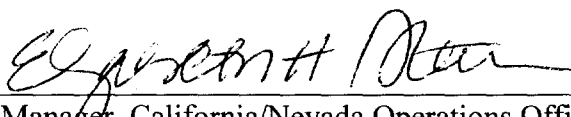


RECOVERY PLAN  
FOR  
SIX PLANTS FROM THE  
MOUNTAINS SURROUNDING  
THE LOS ANGELES BASIN

U.S. Department of the Interior  
Fish and Wildlife Service  
Region 1, Portland, Oregon

Approved: \_\_\_\_\_

**Acting**

  
Manager, California/Nevada Operations Office,  
Region 1, U.S. Fish and Wildlife Service

**SEP 30 1999**

Date: \_\_\_\_\_

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## EXECUTIVE SUMMARY

**Current Species Status:** This recovery plan covers two endangered plant species: *Astragalus brauntonii* (Braunton's milkvetch), and *Pentachaeta lyonii* (Lyon's pentachaeta); and four threatened plant species: *Dudleya abramsii* ssp. *parva* (Conejo dudleya), *Dudleya cymosa* ssp. *marcescens* (marcescent dudleya), *Dudleya cymosa* ssp. *ovatifolia* (Santa Monica Mountains dudleya), and *Dudleya verityi* (Verity's dudleya).

Braunton's milkvetch occurs in 18 current sites in four geographic regions of California, totaling less than 3,000 individuals. All current sites are affected by immediate loss of habitat from development; one population was bulldozed during recent fire suppression activities and another was bulldozed during negotiations to protect the site in August 1998.

Lyon's pentachaeta occurs on 30 current sites, comprising 5 populations, all with fewer than 5,000 individuals. Eleven current sites are threatened with development. One site was recently bulldozed during facility construction for a local water district. No populations are being actively managed or monitored.

Conejo dudleya is restricted to 12 current sites along a (10-mile) stretch of Mountclef Ridge, where it is threatened with development and recreational activities.

Marcescent dudleya occurs at 7 current sites, numbering less than 1,000 individuals, and is threatened by development and recreational activities.

Santa Monica Mountains dudleya occurs at 8 current sites, totaling less 2,000 individuals, and is threatened by development and recreational activities.

Verity's dudleya is restricted to 3 current sites in a 6.4- kilometer (4-mile) stretch at the base of Conejo Mountain where smog damage and quarrying operations are affecting the species habitat quality.

**Habitat and Distribution:** Grassland, coastal sage scrub, and chaparral communities are habitats for all 6 plants which occur in the Santa Monica

Mountains and Simi Hills (Ventura and Los Angeles Counties), the San Gabriel Mountains (Los Angeles County), and the Santa Ana Mountains (Orange County).

The six plant species are threatened by one or more of the following: urban development, recreational activities, alteration of fire cycles, fire suppression and pre-suppression (fuel modification) activities, over collecting, habitat fragmentation and degradation, and competition from invasive weeds. Several of the plants are also threatened with extinction from random events because their numbers and ranges are so limited.

<u>Plant species/subspecies</u>	<u>Recovery Priority:</u>
Braunton's milkvetch, <i>Astragalus brauntonii</i>	8
Lyon's pentachaeta, <i>Pentachaeta lyonii</i>	2C
Conejo dudleya, <i>Dudleya abramsii</i> ssp. <i>parva</i>	2C
Marcescent dudleya, <i>Dudleya cymosa</i> ssp. <i>marcescens</i>	9
Santa Monica Mountains dudleya, <i>Dudleya cymosa</i> ssp. <i>ovatifolia</i>	6
Verity's dudleya, <i>Dudleya verityi</i>	2C

**Recovery Objectives:** The goal of this plan is to stabilize, protect, and/or restore all populations in current locations (including seedbanks) of all six plant species. This will allow for the reclassification of *Astragalus brauntonii* and *Pentachaeta lyonii* to threatened status, with the potential for eventual delisting and the delisting of all of the *Dudleya* species.

**Recovery Criteria:**

Braunton's milkvetch can be considered, for reclassification when all 20 current populations are fully protected (including seedbanks) (see Table 1), and managed with the primary intention of preserving the populations in perpetuity; seed is securely stored and plants are successfully germinated from collected seed and/or historic sites e.g. propagation techniques for reintroduction are developed. Delisting can be considered when monitoring shows that the habitat is secure; provisions for ecological requirements exist; and conditions for the species indicate stability over a minimum of 15 years. This 15 years of monitoring will be extended by an additional 5 years of monitoring which is required by the Endangered Species Act for newly listed species.

Lyon's pentachaeta can be considered for reclassification when 10 populations of 10,000 or more plants, from the 30 current sites (see Table 2), are fully protected and self-sustaining (as demonstrated through monitoring); managed to control threats such as alien plants; and are self-sustaining over a minimum of 15 years (or longer, if data suggest large population fluctuations). Delisting can be considered when 20 populations meet the same criteria.

The *Dudleya* species may individually be considered for delisting when all current populations (including seedbanks) are fully protected and managed with the primary intention of preserving the populations in perpetuity and shown through monitoring, to be self-sustaining over a minimum of 10 years. Refer to the following tables for species occurrences information. *Dudleya abramsii* ssp. *parva* (Table 3), *Dudleya cymosa* ssp. *marcescens* (Table 4), *Dudleya cymosa* ssp. *ovatifolia* (Table 5), and *Dudleya verityi* (Table 6).

#### **Actions Needed**

1. Protect and secure all current sites of these plant species (including seedbanks).
2. Manage and monitor protected areas where plants occur.
3. Survey historic locations and other potential habitat where the six plant species may occur.
4. Conduct biological and ecological research to define life history strategies, population dynamics, and to guide recovery/conservation efforts.
5. Develop public outreach plans to enhance the public's understanding of conservation needs of these endangered and threatened plant species.

**Estimated cost of Recovery:** \$1,338,000 for the first 5 years, with additional costs for the 20 years estimated for delisting.

**Date of Recovery:** *Astragalus brauntonii* and *Pentachaeta lyonii* may be reclassified to threatened status and the *Dudleya* species may be delisted in 2018, if current populations are fully protected and managed.



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## I. INTRODUCTION

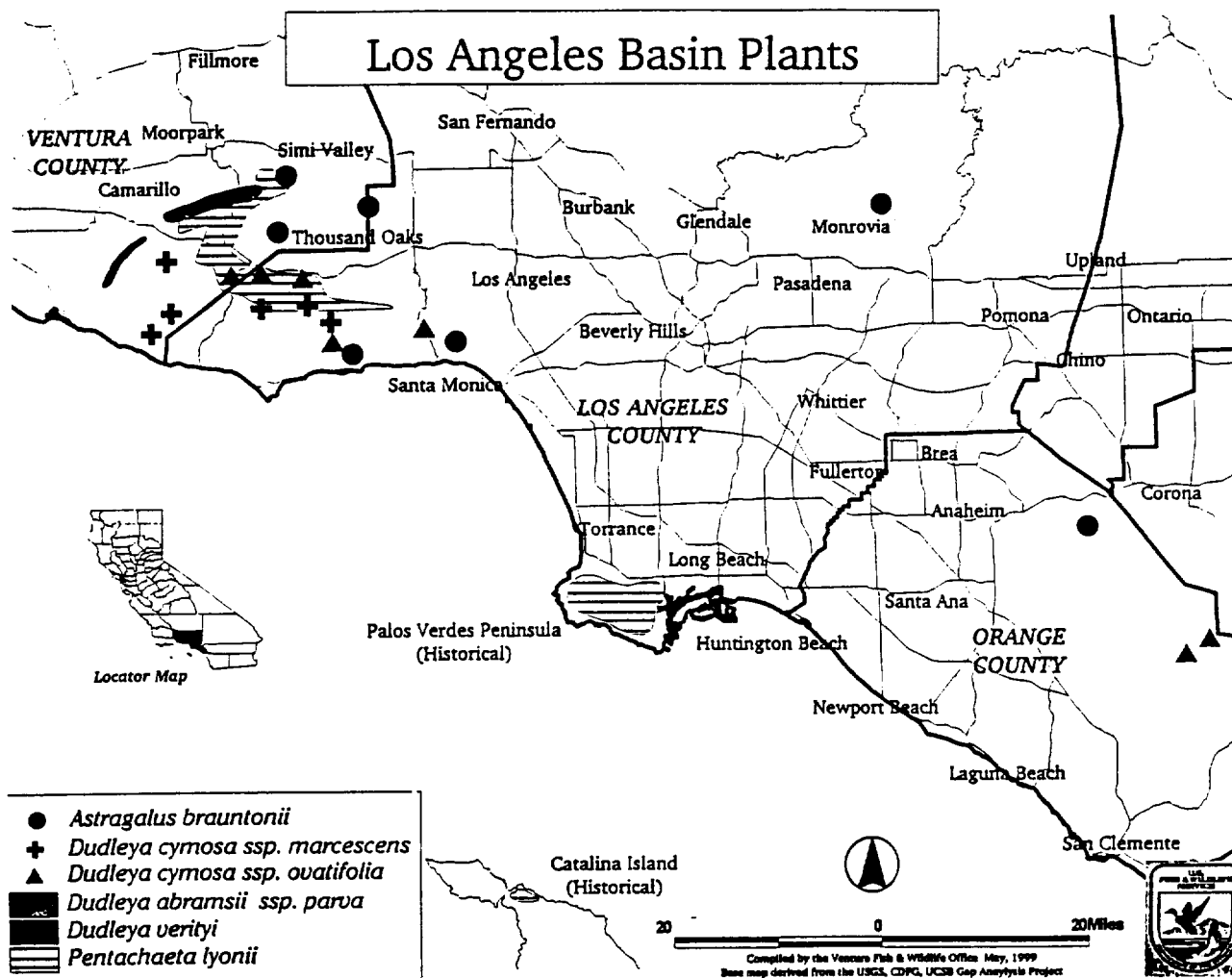
The final rule determining endangered status for *Astragalus brauntonii* (Braunton's milkvetch), *Pentachaeta lyonii* (Lyon's pentachaeta), and threatened status for *Dudleya abramsii* ssp. *parva* (Conejo dudleya), *Dudleya cymosa* ssp. *marcescens* (marcescent dudleya), *Dudleya cymosa* ssp. *ovatifolia* (Santa Monica Mountains dudleya), and *Dudleya verityi* (Verity's dudleya) was published in the January 29, 1997 Federal Register (62 FR 4172).

These six plants are native to the Los Angeles basin in Orange, Los Angeles, and Ventura Counties, California (Figure 1). The lowland plains of the Los Angeles basin are bounded by mountains and hills that expose Mesozoic or older basement rocks, and sedimentary and igneous rocks, of late Cretaceous to late Pleistocene age. The basin's northern and western boundary is formed by the southern portion of the Transverse Ranges, including the San Gabriel Mountains, the Santa Susanna Mountains, the Simi Hills, and the Santa Monica Mountains. The basin is bordered to the south by the Santa Ana Mountains, which are the northern end of the Peninsular Ranges.

The six plants in this plan show strong substrate preferences. *Astragalus brauntonii* often occurs on small limestone (calcium carbonate) outcrops. *Pentachaeta lyonii* is found on clay soils in transition areas between grasslands and shrublands. All of the dudleyas occur on volcanic or sandstone rock outcrops with specific microhabitat characteristics. *Dudleya verityi* and *Dudleya abramsii* ssp. *parva* occur exclusively on outcrops and soils derived from the Miocene Conejo volcanics at the western end of the Simi Hills and the Santa Monica Mountains. *Dudleya cymosa* ssp. *marcescens* occupies the lower slopes of volcanic cliffs in canyons that have perennial moisture. *Dudleya cymosa* ssp. *ovatifolia* is found on rock outcrops, with distinctive forms of the plant restricted to sedimentary conglomerate rock or volcanic breccia (Nakai 1987, NDDB 1998).

California's botanical community considers most of the major habitat types in which these rare plants occur to be sensitive (Holland 1986). These habitat types have been lost, fragmented, and impaired by alteration of natural ecosystem processes due to development, fire suppression activities, cattle grazing, and vegetation type conversion for agricultural purposes (Schoenherr 1990).

Figure 1. Distributions of the six plant species.



*Astragalus brauntonii* is associated with fire-dependent chaparral habitat dominated by *Adenostoma fasciculatum* (chamise), *Yucca whipplei* (yucca), the rare *Cupressus forbesii* (Tecate cypress), and *Nolina cismontana* (chaparral beargrass). Although the grassland habitat in which *Pentachaeta lyonii* occurs is largely dominated by introduced old world grass and herb genera such as *Avena*, *Brassica*, *Bromus*, *Centaurea*, and *Erodium*, several native plant species are present in these grasslands, frequently including the native bunchgrass *Nassella pulchra*. *Dudleya abramsii* ssp. *parva* commonly occurs in a cactus-dominated coastal sage scrub, which provides nesting habitat for the Bell's sage sparrow (*Amphispiza belli belli*) and the Rufous-crowned sparrow (*Amophila ruficeps canescens*), both species of special concern. Most of the coastal sage scrub where *Dudleya verityi* occurs is dominated by *Artemisia californica* (coastal sagebrush), *Eriogonum fasciculatum* (wild buckwheat), *Salvia leucophylla* (purple sage), and occasionally *Coreopsis gigantea* (giant coreopsis). *Dudleya verityi* is associated with *Eriogonum crocatum* (Conejo buckwheat) and *Dudleya blochmaniae* ssp. *blochmaniae* (Blochman's dudleya), both species of special concern. A unique lichen flora of more than 70 species is associated with *Dudleya verityi* and coastal sage scrub habitat on Conejo Mountain (Riefner 1992).

## SPECIES ACCOUNTS

### A. *Astragalus brauntonii* (BRAUNTON'S MILKVETCH)

#### 1. TAXONOMY

*Astragalus brauntonii* was described by Samuel Parish (1903) based on a specimen collected by Dr. H. E. Hasse in 1899 above Santa Monica. It was named for Ernest Braunton. Per Axel Rydberg published the name *Brachyphragma brauntonii* in his revision of the genus. However, Rydberg's fragmentation of the genus *Astragalus* has not been accepted by other botanists. Systematic treatments (Barneby 1964) and floristic treatments (Munz 1974, Spellenberg 1993) recognized Parish's original treatment of this taxon.

#### 2. DESCRIPTION

*Astragalus brauntonii* is a robust, short-lived perennial in the pea family (Fabaceae) (Figure 2) (Hickman 1993). It is one of the tallest members of the

genus, reaching a height of 1.5 meters (5 feet) and is covered with fine, entangled hairs throughout. The stems are white, the leaves pale to greenish. A thick taproot and woody basal stem gives rise to several stems. The 4 to 16 centimeters (1.5 to 6.5 inches) long leaves are pinnately compound with 25 to 33 oblong-ovate, abruptly pointed leaflets. The light purple flowers are clustered in 35 to 60 flowered racemes (flowers are borne on stalks) 4 to 14 centimeters (1.5 to 5.5 inches) long. The beaked, slightly curved pods are oblong-ovoid, 6.5 to 9 millimeters (2.5 to 3.5 inches) long and two-celled, front to back, with three to six seeds. *Astragalus brauntonii* is readily distinguished from the only other perennial species of *Astragalus* in the area, *A. trichopodus*, by being woolly tomentose (covered with densely matted hairs) as opposed to strigose (covered with sharp, stiff-appressed hairs) or glabrous (without hairs), and by the two-chambered, rather than one-chambered pods (Barneby 1964).

### 3. LIFE HISTORY AND HABITAT

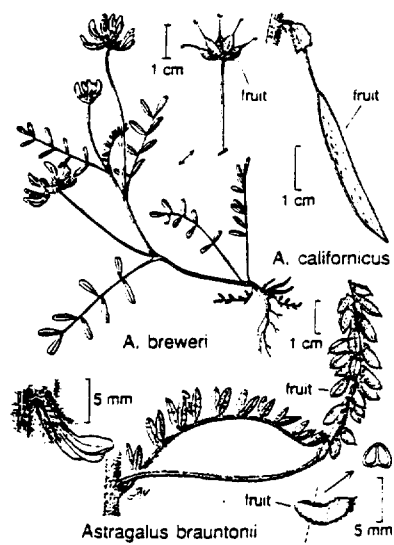
*Astragalus brauntonii* is apparently restricted to carbonate or calcareous soils. The only locations, which are non-carbonate are down-wash sites (into which the seeds would have drifted). The locations are: an occurrence<sup>1</sup> along the edge of a fire road in Monrovia, an occurrence along the banks of lower Malibu Creek, and an unvouchered record for Chino Hills (Sampson 1985) where the location is unspecific. Surveys for *A. brauntonii* conducted as part of post-fire floristic inventories within its current geographic range have so far failed to find it on non-carbonate soils. Carbonate outcrops are extremely rare within the current range of *A. brauntonii*, and as a result, this species is naturally rare. Every population has been compromised by habitat loss and modification.

Seed of this short-lived perennial produced in the rear section of the pod are innately dormant. They have a thickened seed coat typical of many chaparral plants which is adapted to germinate after disturbance from fire or mechanical scarification. The dormancy allows the seed to persist in a soil seed bank for many years. Seed produced in the front of the pod germinates readily (Fotheringham and Keeley 1998). A few sites are self-sustaining, with a

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<sup>1</sup> Occurrence: this term is used in a technical sense by the California Natural Diversity Database and other heritage programs for records of species at particular sites. An occurrence is not necessarily a distinct population.

Figure 2. Diagram of *Astragalus brauntonii*. Copyrights by the Regents of California, reproduced with permission of the Jepson Herbarium, University of California.



complement of seedling to mature individuals in the population. These sites occur on steep side slopes where mechanical abrasion probably scarifies a portion of the seed produced, and where local competition is reduced through the maintenance of open habitat. Seed tests show that viability is 95 percent; about 1 percent of the seed germinated readily with no special treatment, and more than 60 percent germinated with heat treatment (Carroll 1987).

Recruitment of seedlings of *Astragalus brauntonii* is stimulated by fire events and other mechanisms promoting scarification of the seed. The total number of individuals in any given year varies depending on the stage of the fire cycle and site disturbance. The natural fire interval in the habitat of *A. brauntonii* is unknown. Estimates range from 20 to more than 100 years, with an average of 70 year intervals (Minnich 1989; O'Leary 1990). Tecate cypress (*Cupressus forbesii*) forests, where *Astragalus brauntonii* co-occurs, are believed to have 35 to 65 year fire intervals (Spenger *in litt.* 1999). Higher fire frequencies, mostly from arson-set fires, have resulted from increasing human populations in southern California. In 1985, a large population, with approximately 400 individuals, was recorded in Orange County following a 1982 fire. In 1998, only one plant remained in the middle of a fire road in need of repair (Alan Romspert, botanist, Calif. State University, Fullerton, pers. comm. 1998). Some populations have seedling recruitment in the absence of fire. A large population of 2,000 individuals, with seedling to senescent (post-mature) individuals, is persisting in a power line corridor at Temescal Ridge in the Santa Monica Mountains (Fotheringham and Keeley 1998). In the Simi Hills, similar recruitment occurred without fire, on a steep berm year after year, resulting in a stable population of roughly 200 plants until a ball park was built. At the time, the berm was leveled and then rebuilt to almost the same configuration. *Astragalus brauntonii* has not been seen on this site since the reconstruction. Soil from the original berm was used to level the ball field, so the seed bank was spread and hundreds of plants sprouted on the field (C. Wishner, pers. comm. 1998).

Pollinators observed on *Astragalus brauntonii* are primarily native megachilid bees (medium sized, 6 to 12 millimeters [0.2 to 0.4 inch]), and secondarily, a native bumble bee (*Bombus* sp., large sized, 13 to 25 millimeters [0.5 to 1.0 inch]). Pollen found on these insects came from plants including chamise



(*Adenostoma fasciculatum*), scarlet pimpernel (*Anagallis arvensis*), *Encelia californica*, storksbill (*Erodium cicutarium*), arroyo lupine (*Lupinus succulentus*), *Malacothrix saxatilis*, and black sage (*Salvia mellifera*) (Fotheringham and Keeley 1998). Habitat to support these pollinators should include these common or dominant plant species. The life histories of these pollinators are currently unknown.

#### 4. DISTRIBUTION

*Astragalus brauntonii* is currently in four geographic areas, which harbor metapopulations<sup>2</sup> in Ventura, Los Angeles, and Orange Counties (Figure 2) (Table 1). The northwestern region includes three small sites in the Simi Hills. One site was reported with three individuals from the northwest shoulder of the Simi Hills during the public comment period. The occurrences along the south slope of the Simi Hills of eastern Ventura and western Los Angeles Counties include the Oak Park and Palo Comado Canyon sites. There were 1,000 plants at the Oak Park site until 1998, when it was deliberately bulldozed. The species was recorded at the east end of the Simi Hills in Dayton Canyon and there is a historic and current account from Silvernale Ranch in the same vicinity.

The central region includes the core of the Santa Monica Mountains. Two occurrences (one population) are in Santa Ynez Canyon, which probably represents the type locality from above Sherman (now West Hollywood). The occurrence along Temescal Ridge has a reported 2,000 individuals (Fotheringham and Keeley 1998). The historic occurrence near the mouth of Malibu Creek could either represent a downstream wash of seed from the Simi Hills or it could be an expression of nearby occupied habitat. A Malibu occurrence would be considered a significant discovery. The most recent occurrence of this species (100 individuals) has been found along the Lower Zuma Motorway (1999).

The northeastern region is on the south flank of the San Gabriel Mountains along the Clamshell Motorway and Canyon north of Monrovia where a small population has been documented to contain 57 plants in 2 colonies.

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<sup>2</sup> Metapopulation: a group of populations linked by limited genetic interchange, usually (in plants) from dissemination of pollen or seeds.

The southern region has two occurrences (one population) that are in Coal and Gypsum Canyons, partially in a Tecate cypress forest in the Santa Ana Mountains, Orange County (NDDDB 1998). Over 250 plants were recorded from this site in 1986, following a fire. The upper Coal-Gypsum occurrence is now on the Coal Canyon Ecological Reserve managed by the California Department of Fish and Game (Spenger *in litt.* 1999). A portion of that "protected" occupied habitat is likely to be compromised by the construction of a service road for the approved local development. A survey of nearby habitat for *A. brauntonii* in the Cleveland National Forest was designed and implemented by the Cleveland National Forest. Rancho Santa Ana Botanic Garden (RSA) was contracted to conduct the survey. No additional plants were, however, located (Mistretta 1992).

**TABLE 1. *Astragalus brauntonii* occurrences.**

<b>Northwestern Range</b>			
NDDDB <sup>3</sup> Occurrence #	LOCATION	NUMBER OF INDIVIDUALS  (YEAR) (SITE TYPE) Current=C Historic=H	Site OWNER/MANAGER
no #	Bus Canyon	3 (1997) 3 (1999) C	unknown
7	Silvernale Ranch	historic collection (1949) 3 (1999) C	unknown
11	Oak Park Community Park	100 (1985) 390 (1993) 2 (1996) C	Rancho Simi Park District
19	Palo Comado	30 (1987) 2 (1996) C	National Park Service
20	Oak Park Deerhill Park	5 (1990) 2-300 (1997) 10 (1998) C	Private

21	Oak Park III	15 (1990) Transplanted 387 (1995) Transplanted 1 (1998) C	Private
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**Table 1. *Astragalus brauntonii* occurrences continued.**

	Falling Star	15 (1989) 29 (1992) 0 (1996) C	COSCA
23	Dayton Canyon	2 (1989) 6 (1999) C	Private

**Central Range**

3	Lower Malibu Creek	1 (1984) C	CDPR/Private
8	Los Liones Canyon	10 (1975) 0 (1996) C	CDPR
14	Trailer Canyon	(1987) (1988) (1996) C  200 11 0	CDPR/Private
15/17	Temescal Ridge Topanga State Park	1 (1987) less than 2,000 (1996) C	CDPR/Private/City of Los Angeles
18	Temescal Canyon	2 (1942) C	City of Los Angeles
--	Lower Zuma Motorway	100 (1999) C	National Park Service

**Northeastern Range**

6	Monrovia	3 (1980) 0 (1986) C	Private (Developed)
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16	South of Clamshell truck tr.	42 (1993) 2 (1996) C	Private
24	lower Clamshell motorway	3 (1994) 2 (1996) C	Private
no #	east Clamshell truck trail	less than 30 (1997) 31 (1998) C	Private

**Table 1. *Astragalus brauntonii* occurrences continued.**

**Southern Range**

4	Coal/Gypsum	151 (1986) 1 (1994) 0 (1997) C	Private
10	S. Coal Canyon	250 (1986) 0 (1997) C	Private

NDDB: California Natural Diversity Database, California Department of Fish and Game  
 COSCA: Conejo Open Space Conservation Authority  
 CDPR: California Department of Parks and Recreation

**5. REASONS FOR DECLINE AND THREATS**

Most of the habitat for *Astragalus brauntonii* is on lands in private ownership in areas with expanding development. *Astragalus brauntonii* is present in small colonies on land managed by four public agencies including the California Department of Parks and Recreation (CDPR), the Conejo Open Space Conservation Agency (COSCA), the Rancho Simi Parks and Recreation District, and the National Park Service (NPS). The small colonies within their

jurisdictions are not large enough to offer long term protection for the species. All of the protected habitat is in the immediate vicinity of urban development. *Astragalus brauntonii* is threatened by direct loss from urban development, fragmentation of habitat, reduction of necessary pollinators and their associated species, threats from fire suppression activities, and random, naturally occurring extinction due to disturbances in small population sizes, generally with low numbers of individuals (NDDDB 1998). When small populations of *Astragalus brauntonii* (or other rare plants and/or sensitive natural resources) occur on publicly-owned sites, their protection and management is often a secondary priority to recreation or landscaping.

Mitigation for the loss of habitat occupied by State-listed species is often not secured in California. When a proposed development causes loss of habitat occupied by State-listed species, the lead agency approving the development must require mitigation to reduce that loss. For instance, in 1985, Ventura County (acting as lead agency for a proposed development) required a germination study and mitigation plan for the loss of occupied habitat caused by construction of a development along upper Medea Creek (Carroll 1987). Although the germination study was conducted, unfortunately the mitigation plan was not implemented. Subsequent development was also approved in the immediate vicinity, with required mitigation. Later, the mitigation requirements were changed to eliminate on-site mitigation through a procedure for making a "minor modification" to the project. Even though the Ventura Fish and Wildlife Office established a point of contact in 1992 by providing comments on the project, the developer directed a 20-day response request for assistance to establish a rare plant preserve to the Director of the U.S. Fish and Wildlife Service in 1995 during the minor modification process. In 1998, during negotiations between the County of Ventura, the Service, the California Department of Fish and Game, local conservation organizations, and the developer, to provide protection for *Astragalus brauntonii* on the site, the plants, and their habitat were deliberately destroyed by the developer, with the approval of Ventura County.

Development in the Santa Ynez Canyon, in the Santa Monica Mountains, has removed an unspecified amount of habitat, and is immediately adjacent to the *Astragalus brauntonii* populations there. In 1997, the City of Monrovia prepared

the Madison Specific Plan for development. This plan allowed for the removal of *Astragalus brauntonii* habitat and placed development in close proximity to occupied habitat. The City of Anaheim has approved a development that is expected to remove approximately 50 percent of the plant's habitat in the northern Santa Ana Mountains. This development additionally compromises the habitat set aside as mitigation with an access road to the water tank that will support the development. Despite full knowledge of these predicted losses of plant habitat, actions have been insufficient to prevent cumulative impacts to this rare plant species.

## 6. CONSERVATION EFFORTS

Section 6 of the Endangered Species Act of 1973, as amended, authorizes assistance for implementation of State programs to conserve endangered and threatened species. A section 6 project was funded by the Service to study the ecology and distribution of *Astragalus brauntonii*. The results of the study provide a basis for understanding soil seed banks and pollination requirements. This information was used to better define recovery actions and needs (Fotheringham and Keeley 1998). Preliminary germination and growth experiments at the Rancho Santa Ana Botanic Gardens have been successful, and their continuing efforts should provide a better working knowledge for repatriation efforts.

In 1987, a mitigation plan required by the Ventura County Planning Department for the loss of habitat and individuals was prepared by the Santa Barbara Botanic Garden (Carroll 1987). The plan specified the following measures to re-establish and manage *Astragalus brauntonii*: 1) a reserve should be established away from existing and future development, 2) within the reserve, a population of 600 individuals should be managed by a qualified horticulturist (based on a loss of about 610 square meters (2,000 square feet) of habitat, compared to an existing site), 3) planting should be done in the fall, and supplemental watering should be provided in case of drought, 4) the project should be monitored every 3 months, for a 5-year period, to document success/failure, 5) seed of the species should be gathered, and spread onto suitable habitat to increase the chance of establishing additional populations, 6) seed should be collected and conserved, 7) specific surveys should be done before any further construction in the area to avoid

additional losses, and 8) a fire management plan should be developed to ensure survival of this species (Carroll 1987). Although the plan was never implemented, it provided a valuable basis for future management of the species. See section G (page 34) for information on available conservation measures.

## B. *Pentachaeta lyonii* ( LYON'S PENTACHAETA)

### 1. TAXONOMY

*Pentachaeta lyonii* was described by Asa Gray (1886) based on a plant collected by William S. Lyon "near Palos Verdes Mountain" in Los Angeles County. David D. Keck (1958) combined *Pentachaeta* with *Chaetopappa* and published the combination *Chaetopappa lyonii*. This was recognized by Munz and Keck (1959) and Munz (1974). Van Horn (1973) conducted a taxonomic status of *Pentachaeta* and *Chaetopappa* and demonstrated that the two genera were distinct in morphological, anatomical features, and breeding systems. This treatment has been followed in current floristic treatments (Raven *et al.* 1986, Lane 1993).

### 2. DESCRIPTION

*Pentachaeta lyonii* is 6 to 48 centimeters (2.4 to 18.9 inches) tall and is an annual member of the aster family (Asteraceae) with yellow flower heads, flowering in the late spring (April to June). It is distinguished from other members of the genus by its reddish branches originating from the upper portion of the plant, its pubescent phyllaries (bracts at the base of the flower head), and larger numbers of fragile pappus bristles atop the fruit (Figure 3). The corollas (united petals) of the ray flowers are typically curled early in the day. The leaves are narrowly linear, with ciliate margins (Van Horn 1973). There are no other members of the genus in the region. Its alternate leaves easily distinguish it from the common associated species *Lasthenia californica* (goldfields), which has opposite leaves.

### 3. LIFE HISTORY AND HABITAT

*Pentachaeta lyonii* occupies pocket grassland sites that are ecotonal (transitional) to shrublands occurring in openings in the chaparral, coastal sage scrub, and along edges of roads and trails. Undisturbed natural habitat of *P. lyonii* is characterized by a low proportion of total vegetative cover and exposed soils with a microbiotic crust (Belnap 1990), which partially reduces competition with other species. Rodents (*Perognathus* spp. and *Peromyscus* spp.) and harvester ant colonies (*Pogonomyrex* spp.) also manage the density of associated vegetation by reducing competition (Thomas and Wishner 1988). Typical native species associated with *P. lyonii* include Turkish rugging (*Chorizanthe staticoides*), Catalina mariposa



Figure 3. Diagram of *Pentachaeta lyonii*. Photo credited to Tim Thomas, Botanist for the U.S. Fish and Wildlife Office, Ventura, California.



lily (*Calochortus catalinae*), purple needle-grass (*Nassella pulchra*), cud weed aster (*Lessingia filaginifolia*), golden stars (*Bloomeria crocea*), erect plantain (*Plantago erecta*), Spanish carpet (*Lotus purshianus*), (*Trifolium wildenovii*), (*Filago californica*), popcorn flower (*Cryptantha micromeres*), (*Eriastrum sapphirinum*), and miniature lupine (*Lupinus bicolor*) (Thomas and Danielsen 1984; Thomas and Wishner 1988; Edgington *in litt.* 1999).

*Pentachaeta lyonii* is dependent upon its pollinators for successful reproduction. In a study funded by the Southwest Parks and Monuments Association, 29 insect visitors from 7 orders were recorded during the 1998 flowering season (Edgington *in litt.* 1999). Hoverfly (*Mesograpta marginata*), Deerfly (*Lepidanthrax* sp.), Andrenid bee (*Andrenidae*), and Megachilid bee (*Ashmeadiella californica californica*) were the most commonly recorded visitors to *Pentachaeta lyonii*, each of which were active at different times of the season (Edgington *in litt.* 1999). In another study, digger bees (*Anthophoridae*) were observed to be the most frequent visitors with bee flies (*Bombyliidae*) the next dominant visitor (Fotheringham and Keeley 1998). Pollen analyzed from three of the frequent visitors included; *Adenostoma fasciculatum*, *Brassica nigra*, *Centaurea melitensis*, *Clarkia purpurea*, *Dichelostemma capitatum*, *Hemizonia fasciculata*, *Salvia leucophylla*, as well as *Pentachaeta lyonii* (Edgington *in litt.* 1999). Understanding and protecting the ecological requirements of pollinators and their habitat will be necessary to successfully protect and recover *Pentachaeta lyonii*.

The seed of *Pentachaeta lyonii* germinates readily, without fire-related cues (heat, smoke, charates) (Keeley 1995). Since *P. lyonii* does not compete well with dense annual grasses or native shrubs, fire may play a role by opening up habitat and temporarily reducing spatial competition.

#### 4. DISTRIBUTION

There are very few collections of *Pentachaeta lyonii*; the majority were made around the turn of the century from locations where the species has been extirpated (San Pedro, Wilmington, Palos Verdes Peninsula, and Santa Catalina Island). The first record from the Santa Monica Mountains was made in 1926, from an unknown location in the Malibu Hills (NDDDB 1998) (Table 2). It was

**TABLE 2. *Pentachaeta lyonii* occurrences**

NDDB Occurrence #	LOCATION	NUMBER OF INDIVIDUALS	(YEAR) (SITE TYPE) Current=C Historic=H	SITE OWNER/ MANAGER
1	Point Fermin	collection	(1931) H	Unknown
3	Stunt Ranch	fewer than 1,000 fewer than 100 fewer than 10 12 3 0 0	(1982) (1984) (1987) (1988) (1989) (1990) (1995) C	University of California Natural Reserve System
4	Saddle Rock Ranch	collection	(1964) H	Private
5	Westlake Blvd 2080 Feet	fewer than 100 0 0	(1982) (1987) (1990) C	Private
6	Rocky Oaks	10,000 fewer than 100 fewer than 1,000	(1982) (1987) (1988) C	NPS
9	Malibu Creek State Park	fewer than 100 fewer than 50 3 0	(1983) (1984) (1988) (1994) C	CDPR
10	West Side of Westlake Blvd	more than 1,000 1,000 more than 1,000 more than 1,000	(1983) (1987) (1988) (1990) C	COSCA
11	Ridge above Lake Eleanor	fewer than 100 0	(1983) (1987) C	Private
12	Wildwood Park	more than 1,000 more than 1,000 more than 1,000	(1984) (1987) (1988) C	COSCA

**TABLE 2. *Pentachaeta lyonii* occurrences (continued)**

13	Malibu Hills	herbarium specimen (No Date) H	Unknown
14	Wood Ranch	400 (1989) C	Private
15	Lake Sherwood	4,076 (1990) fewer than 4,000 (1993) C	Private
16	Lake Sherwood, North	330 (1990) C	Private
17	Upper Carlisle	more than 100 (1993) C	Private
18	Eagles Nest Mulholland Highway	200 (1989) C	Private
19	Lake Sherwood Southwest	3,200 (1987) 200 (1988) 40 (1992) 7 (1993) 1 (1994) C	Private
20	South of Olsen Road	200 (1988) C	Private
21	North of Olsen Road	20 (1991) 100 (1994) C	Private
22	Seventh-day Adventist	fewer than 100 (1991) 200 (1993) C	Private
23	Newbury Park Academy	200 (1991) 1,000 (1993) C	Private
24	Lynnmere	500 (1991) C	COSCA
25	O.3 miles east of Montclef Peak	200 (1994) C	Private
26&27	Baldwin Westlake	more than 5,000 (1992) C	Las Virgenes MWD/Owner; SMMC/Manager
28	Lake Eleanor Hills	more than 1,200 (unknown) 6,000-9,000 (1991) 7,500 (1992) C	Private
29	Reagan Library	0 (1999) H	Private

30	Carlsberg	1,000 (1991) C	Private
31	Clovercast	60 (1991) C	Private
32	Bridgegate	11,050 (1991) C	Private
33	Cornell Fire Station	4,000 (1992) C	Private
34	East Ladyface	4,000 (1992) C	Private
35	Malibu Lake	Observed (1996) C	Private
36	Hill Canyon	30 (1996) C	Private
no #	265 Decker Canyon	1000 (1998) C	Private
no #	Ridge east above intersection of Decker and Potrero	1000 (1998) C	Private
no #	Wilmington	Collection (1900) H	unknown
no #	San Pedro	Collection (1899) H	unknown
no #	Palos Verdes	Collection (1910) H	unknown
no #	Palos Verdes Mountain	leucotype collection (1886) H	unknown
no #	Santa Catalina Island	Collection (1885) H	Private

NDDDB: California Natural Diversity Database, California Department of Fish and Game

COSCA: Conejo Open Space Conservation Authority

CDPR: California Department of Parks and Recreation

NPS: National Park Service

MWD/SMMC: Municipal Water District/Santa Monica Mountains Conservancy

not until 1963, when Peter Raven was collecting for his 1966 Flora of the Santa Monica Mountains, that *P. lyonii* was again documented from the Santa Monica Mountains (Van Horne 1973). That population has since been extirpated by habitat conversion to agriculture (NDDDB 1998). In 1977, David Verity discovered the easternmost population of *P. lyonii* in the Santa Monica Mountains at Stunt Ranch. It has since been extirpated through site alteration by gopher activity that turned over the soil, allowing an increase in non-native weeds (NDDDB 1998). The species is currently defined from 5 meta-populations, spread over 30 current sites (including seedbanks), in the central

Santa Monica Mountains along the northern slopes, which run through Thousand Oaks, and around the western edge of the Simi Hills to the western edge of the City of Simi Valley (Figure 1) (Table 2). This species ranges over approximately 32 kilometers (20 miles) and is distributed in a highly fragmented landscape.

#### 5. REASONS FOR DECLINE AND THREATS

Primary threats include direct loss of habitat and the influence of development in proximity to existing populations (fuel modification). The introduction of competitive weeds that displace *Pentachaeta lyonii*, changes in local hydrology which can encourage invasive weeds, intensive gopher activity altering the soil integrity, and the alteration of habitat structure from nearby development have negatively affected populations in Ventura County.

Mitigation for development projects has not provided adequate protection for the species. Attempts to create new sites have not met with success, largely because non-native annual grasses have displaced the species. Protection of existing populations have also failed because the areas set aside as reserves have been too small or too close to developments. For example, a 61 meter (200 foot) buffer was established between designated rare plant habitat and a fuel modification development. The buffer was however, destroyed in compliance with fire insurance requirements to clear an additional 30 meters (100 feet). Attempts to mitigate loss of habitat at sites such as the Lake Sherwood golf course (through planting seeds and seedlings) have also failed.

#### 6. CONSERVATION EFFORTS

A study of the ecology and distribution of *Pentachaeta lyonii* was funded under section 6 of the Act, to better define recovery needs (Fotheringham and Keeley 1998). The results provide a preliminary understanding of soil seed banks and pollination requirements (see section 3 above). The California Department of Fish and Game funded a study on the seed germination and dormancy of *Pentachaeta lyonii* through an emergency drought relief project (Keeley 1995). Results from this project indicated that the seed is not adapted to germinate in response to fire, contrary to observations presented in the final rule listing the species. These and additional studies will be useful in managing the species for recovery.

The National Park Service has fenced a small site to protect it from trampling by hikers and equestrians. There is an occurrence protected along Westlake Boulevard by Conejo Open Space Conservation Authority. The City of Thousand Oaks manages a site at Wildwood Park. The Santa Monica Mountains Conservancy (SMMC) is managing a site near the Baldwin reservoir. All but the last site comprise a small portion of the distribution of the species, and additional protection and management is still needed. The species was listed as endangered by the State in 1990. See section G (page 34), for information on available conservation measures.

### **C. *Dudleya abramsii* spp. *parva* (CONEJO LIVE-FOREVER)**

#### **1. TAXONOMY**

*Dudleya* (live-forever) is a genus comprising species of succulent, rosette-forming perennial plants in the stonecrop family (Crassulaceae). These plants frequently inhabit rocky soils or rock outcrops along the coast, and in interior mountain ranges. Many species of *Dudleya* are highly localized in their distribution because of the patchy and limited distribution of such habitats within other plant community types. The Santa Monica Mountains contains one of the most diverse concentrations of taxa in this genus.

In California, 39 taxa (species and subspecies) of *Dudleya*, belonging to 3 subgenera (*Dudleya*, *Hasseanthus*, and *Stylophyllum*), are recognized (Bartel 1993). All four *Dudleya* species included in this recovery plan are members of the subgenus *Dudleya*. Subgenus *Dudleya* is separated from the other two subgenera by having above ground caudices (stems), sepals that are erect to only slightly spreading at tips, and generally erect follicles (fruit). However, *Dudleya abramsii* and *Dudleya cymosa* ssp. *marcescens* are unusual in the subgenus in that their leaves are vernal.

*Dudleya abramsii* ssp. *parva* was described in 1923 as *D. parva* by Joseph N. Rose and Anstruther Davidson (Moran 1948) based on a cultivated collection made a year earlier by Mrs. J. H. Bullard from the Conejo Grade in Ventura County. Neither Jepson 1925, nor Jepson 1936, mentioned the plant. Munz (1935) listed *D. parva* as a synonym of *Echeveria lanceolata*. Moran (1960)

recognized *D. parva* at the species rank in his treatment of the genus (Moran 1960). This treatment was followed in the floristic treatment of Munz and Keck (1959) and Munz (1974). Bartel (1991) published the combination *D. abramsii* ssp. *parva*, recognizing the similarity of floral features between *D. parva* and *D. abramsii*. This was followed in his floristic treatment of the California dudleyas (Bartel 1993).

## 2. DESCRIPTION

*Dudleya abramsii* ssp. *parva* forms a rosette of leaves that are much longer than wide and widest above the middle (oblanceolate), 1.5 to 4 centimeters (0.6 to 1.6 inches) long, 3 to 6 millimeters (0.1 to 0.2 inch) wide, and, unlike most species in the subsection *Dudleya*, are vernal, withering by early summer. The inflorescence axis (flowering stem) is 5 to 18 centimeters (2.0 to 7.1 inches) long. The flower petals are pale yellow that are often flecked with red on the keel. The roots are constricted at irregular intervals (Munz 1974). *Dudleya abramsii* ssp. *parva* is distinguished by its yellow flowers from *Dudleya blochmaniae* ssp. *blochmaniae*, which has white flowers, and by its vernal leaves rather than the evergreen, persistent leaves found in other *Dudleya* taxa in similar habitat.

## 3. DISTRIBUTION

*Dudleya abramsii* ssp. *parva* has a limited, discontinuous distribution extending from the western terminus of the Simi Hills, west along the Montelef Ridge north of Thousand Oaks to the Conejo Grade, in a distance of approximately 16 kilometers (10 miles) (Figure 1) (Table 3). This taxa has not been found south of the Ventura Freeway (US 101).



**TABLE 3. *Dudleya abramsii* ssp. *parva* occurrences**

NDDB Occurrence #	LOCATION	NUMBER OF INDIVIDUALS	(YEAR) (SITE TYPE) Current=C Historic=H	SITE MANAGER/ OWNER
	McCrea Wildlife Preserve	Observed (Observed) fewer than 10,000 2,000-3,000	(1948) (1983) (1987) C	COSCA
5	North of Conejo Grade	600	(1983) C	Private
6	Conejo Grade at 1.8 kilometers (1.1 miles) southwest of Oak Grove County Park	Observed	(1987) C	Private
7	North Side Conejo Creek	Observed	(1991) C	Private
8	No. of 101 Just North of Parkway 915	200 300	(1991) (1993) C	Private
9	North Fork Arroyo Conejo	Observed	(1984) C	Ventura County Parks & Recreation
10	Western California Lutheran University	50	(1991) C	Private
12	West End Montclef Ridge	Observed	(1984) C	Ventura County Parks & Recreation
13	Upper No. Fork Arroyo Conejo	Observed	(1980) C	Unknown
15	East Montclef Ridge	fewer than 100	(1991) C	Private
16	East Montclef Peak	25	(1991) C	Private

NDDB: California Natural Diversity Database, California Department of Fish and Game  
 COSCA: Conejo Open Space Conservation Authority

#### 4. LIFE HISTORY AND HABITAT

*Dudleya abramsii* ssp. *parva* is a perennial, succulent herb with little known about its life history. This species has a unique habitat preference compared to all but one of the other local dudleyas. Both *D. abramsii* ssp. *parva* and *D. blochmaniae* ssp. *blochmaniae* grow in shallow, rocky soils in grassland and coastal sage habitat. *Dudleya abramsii* ssp. *parva* is restricted to soils derived from the Conejo volcanics, and usually grows at the base of small, scattered rock outcrops. Associated species include California sagebrush (*Artemisia californica*), Blochman's dudleya (*D. blochmaniae* ssp. *blochmaniae*), chalk dudleya (*D. pulverulenta*), Conejo buckwheat (*Eriogonum crocatum*), wild buckwheat (*E. fasciculatum*), (*Pentachaeta lyonii*), and non-native annuals.

#### 5. REASONS FOR DECLINE AND THREATS

Threats to Conejo dudleya include urban development, fire management and suppression activities (habitat disruption from bulldozer and hand lines and fuels modification around dwellings), establishment of equestrian facilities on occupied habitat, recreational activity that uproots plants (hiking and equestrian use), and removal by plant collectors (NDDDB 1998).

#### 6. CONSERVATION EFFORTS

A portion of the plant's habitat is on lands designated as protected "open space" by Conejo Open Space Conservation Authority; the remaining habitat is privately-owned. See section G (page 34), for information on available conservation measures.

### **D. *Dudleya cymosa* ssp. *marcescens* (MARCESCENT DUDLEYA)**

#### 1. TAXONOMY

*Dudleya cymosa* was described by Charles Antoine Lemaire in 1858 as *Echeveria cymosa* based on a collection sent to him by horticulturist Louis de Smet of Ledeburg, Belgium; unfortunately, the type locality is unknown and the type specimen has been lost (Moran 1951). Britton and Rose (1903) included this species in their newly described genus *Dudleya*, as *D. cymosa* (Moran 1951). Other subspecies of *D. cymosa* range throughout the Sierra Nevada, the coast

ranges, the transverse ranges, and the northern portion of the peninsular ranges. The two subspecies treated in this recovery plan have very restricted distributions.

*Dudleya cymosa* ssp. *marcescens* was described by Moran (1957) based on a specimen he collected in 1948 in Little Sycamore Canyon, of the Santa Monica Mountains, Ventura County. This taxa was first noted by Charlotte M. Hoak, in 1932, in the same canyon as Moran made his later collection (Rooksby 1936).

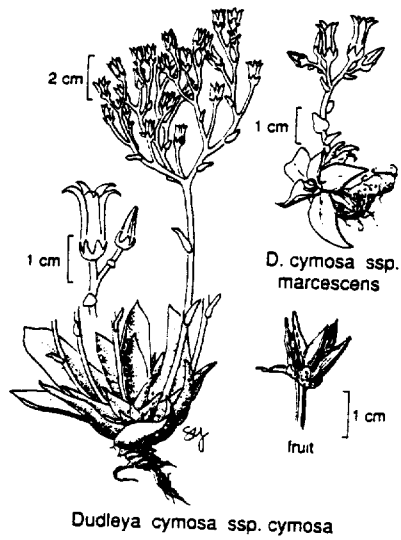
## 2. DESCRIPTION

*Dudleya cymosa* ssp. *marcescens* differs from other subspecies of *D. cymosa* in that its rosette leaves wither in the summer, but do not fall off (i.e., they are marcescent). The rosette leaves are 1.5 to 4 centimeters (0.6 to 1.6 inches) long, 5 to 12 millimeters (2.0 to 4.7 inches) wide; the caudex (stem) is 2 to 7 centimeters (0.8 to 2.8 inches) thick, flowering stems are 4 to 10 centimeters (1.6 to 4 inches) tall and the corolla is bright yellow, to yellow with red markings, to bright red (Munz 1974) (Figure 4) (Hickman 1993).

## 3. DISTRIBUTION

*Dudleya cymosa* ssp. *marcescens* comprises seven populations in the Santa Monica Mountains, from Hidden Valley to Malibu Creek State Park; a distance of 24 kilometers (15 miles) (Figure 1). Estimates of the number of individuals at each site are between 50 and 200 plants (Table 4). The total number of individuals is estimated to be fewer than 1,000. The microhabitat requirements of the plant and

Figure 4. Diagram of *Dudleya cymosa* ssp. *marcescens*. Copyrights by the Regents of University of California, reproduced with the permission of Jepson Herbarium, University of California.



**TABLE 4. *Dudleya cymosa* ssp. *marcescens* occurrences**

NDDB Occurrence #	LOCATION	NUMBER OF INDIVIDUALS	(YEAR) (SITE TYPE) Current=C Historic=H	SITE OWNER/MANAGER
1	Seminole Hot Springs	fewer than 50	(1982) C	Private
2	Yerba Buena Road	4	(1978) C	Private
3	Yerba Buena/Cotharin	Abundant 100	(1974) C	Private
4	Yerba Buena Road	Observed	(1932) H	Private
5	Salvation Army Camp	Observed	(1979) C	Private
6	Rock Pool, Malibu Creek State Park	fewer than 50	(1981) C	State Parks
7	Udell Gorge, Malibu Creek State Park	Observed	(1984) C	State Parks
8	Hidden Valley	more than 100	(1984) C	Private

NDDB: California Natural Diversity Database, California Department of Fish and Game

limited distribution of the plant's potential habitat, limit the possibility that any additional large populations will be found.

#### 4. LIFE HISTORY AND HABITAT

*Dudleya cymosa* ssp. *marcescens* is a succulent, perennial herb with a thickened rootstock, and leaves that wither in summer drought. Little is known about the life history of this species other than the fact that hummingbirds and bees pollinate the plants, and abundant, small seed is produced. *Dudleya cymosa* ssp. *marcescens* typically occurs on the lower reaches of sheer volcanic rock surfaces and canyon walls adjacent to perennial streams in a coastal live oak (*Quercus agrifolia*) woodland often with California Bay (*Umbellularia californica*). In most locations, the topographic relief has prevented deep soil

formation; therefore, this dudleya may be the only flowering plant occurring in a microhabitat that is otherwise dominated by mosses, lichens, and ferns (*Pellaea andromedifolia*, and *Polypodium californicum*) (NDDDB 1998).

## 5. REASONS FOR DECLINE AND THREATS

The plant is threatened by recreational use (particularly rock climbing), collection, and fire. One occurrence is on a site with an administrative easement where the land owner has drastically altered the native vegetation (pine plantings in a cleared oak grove). Populations of *Dudleya cymosa* ssp. *marcescens* are often affected by unregulated recreation (boulder hopping, rock climbing) on California Department of Parks and Recreation and National Park Service lands.

## 6. CONSERVATION EFFORTS

Three populations are protected from development in Malibu Creek State Park, as well as one population on National Park Service land in the west fork of upper Arroyo Sequit drainage. The remaining locations are on private lands. In 1978, the species was listed as rare by the State. See section G (page 34), for information on available conservation measures.

### **E. *Dudleya cymosa* ssp. *ovatifolia* (SANTA MONICA MOUNTAINS DUDLEYA)**

#### 1. TAXONOMY

*Dudleya cymosa* ssp. *ovatifolia* was originally described as *Dudleya ovatifolia* by Britton (1903) based on a collection made by H.M. Hall in 1902. The type locality is listed as "Sierra Santa Monica," thought to be Topanga Canyon, Los Angeles County (Moran 1951). The species was subsequently recognized as *Cotyledon ovatifolia* and *Echeveria ovatifolia* (Fedde 1904 and Berger 1930 respectively, cited in Moran 1951) when different generic concepts were used in the family Crassulaceae. Moran (1957) published the currently accepted combination of *Dudleya cymosa* ssp. *ovatifolia*.

Nakai (1983) considered plants from near Agoura, Los Angeles County to be distinct from *Dudleya cymosa* ssp. *ovatifolia*. Subsequently, (Nakai 1987)

published the new name *D. cymosa* ssp. *agourensis*. Nakai distinguished the new subspecies from the other on the basis of number and shape of rosette leaves, pedicel length, and degree of spreading in petal apices. Nakai (1987) considered *D. cymosa* ssp. *agourensis* to differ from *D. cymosa* ssp. *ovatifolia* in having a simple- to several-branched caudex and glaucous elliptical basal leaves. Nakai (1987) noted that *D. cymosa* ssp. *ovatifolia* has an unbranched caudex and green, ovate basal leaves. Bartel (1993) apparently considered these differences consistent, and included *D. cymosa* ssp. *agourensis* in *D. cymosa* ssp. *ovatifolia* in his treatment of the genus *Dudleya*, for the Jepson Manual.

## 2. DESCRIPTION

Like most members of the section *Dudleya*, *D. cymosa* ssp. *ovatifolia* has evergreen rosette leaves rather than marcescent leaves that wither in the summer. Leaves are 2 to 5 centimeters (0.8 to 2.0 inches) long, 1.5 to 2.5 centimeters (0.6 to 1.0 inch) wide; floral stems are 4 to 15 centimeters (1.6 to 6.0 inches) tall; corollas are pale yellow (Munz 1974). The ovate leaves with a maroon underside, distinguish "*ovatifolia*" in Nakai's narrow sense from other local *Dudleya*, while glaucous leaves and lemon yellow flowers separate the "*agourensis*" form from other local species.

## 3. DISTRIBUTION

*Dudleya cymosa* ssp. *ovatifolia* is found scattered along exposed north-facing slopes of the Santa Monica Mountains from near Westlake Village to Agoura ("*agourensis*"), and in deep canyon bottoms along lower Malibu Creek and Topanga Creek in the Santa Monica Mountains (Figure 1). In the Santa Ana Mountains there are populations in Modjeska Canyon and Modjeska Peak. Fewer than 10 locations of *D. cymosa* ssp. *ovatifolia* have been reported, each consisting of no more than several hundred individuals (Table 5). While future

**TABLE 5. *Dudleya cymosa* ssp. *ovatifolia* occurrences and locations.**

NDDDB Occurrence #	LOCATION	NUMBER OF INDIVIDUALS	(YEAR) (SITE TYPE) Current=C Historic=H	SITE OWNER/MANAGER
1	Modjeska Canyon	fewer than 1,000	(1989) C	Orange County Parks
2	Topanga Canyon	Observed	(1984) C	CDPR
3	Triunfo Canyon	Observed	(1986) C	Private
4	Ladyface	Observed	(1990) C	Private
5	Cornell Corners	Observed	(1990) C	Private
6	Potrero	Observed	(1990) C	Private
7	Lake Eleanor	100	(1986) C	COSCA
8	Arroyo Sequit	Herbarium label	(1960) H	Private
9	Slopes Modjeska Peak	500	(1997) C	USFS/Cleveland National Forest

NDDDB: California Natural Diversity Database, California Department of Fish and Game

COSCA: Conejo Open Space Conservation Authority

CDPR: California Department of Parks and Recreation

USFS: U.S. Forest Service

surveys may locate additional populations of the "Agoura" form along the northern slopes of the Santa Monica Mountains, the limited habitat available makes it unlikely that the total number of individuals will exceed several thousand (NDDDB 1998).

#### 4. LIFE HISTORY AND HABITAT

*Dudleya cymosa* ssp. *ovatifolia* is a succulent, perennial herb, with a thickened rootstock, persisting in exposed dry habitats. Very little is known of this species life history. The typical *Dudleya cymosa* ssp. *ovatifolia* is situated on shaded slopes and canyon bottoms on sedimentary conglomerate rock. The "Agoura" form occurs on a band of late Pleistocene dissected gravels that supports a



sparser grassland habitat than the surrounding vegetation on the north slope of Ladyface Mountain (Dibblee and Ehrenspeck 1993). This habitat band is at road level, to the east of Kanan Road, and gradually climbs in elevation to the west. In the vicinity of Reyes Adobe Road, the band is just at the 405-meter (1,000-foot) contour (Envicom 1998).

#### 5. REASONS FOR DECLINE AND THREATS

Populations of *Dudleya cymosa* ssp. *ovatifolia* in Malibu and Topanga Canyons occur largely on lands owned and managed by California Department of Parks and Recreation. While one of these populations is relatively inaccessible, another is directly adjacent to private property that has been bulldozed for development access (Suzanne Goode, Resource Ecologist, California Department of Parks and Recreation, Santa Monica Mountains, pers. comm., 1992). Most of the remaining populations are along the north slope of Ladyface Mountain, on several privately-owned properties zoned for commercial and residential development. The City of Agoura Hills has a restriction on grading above the 445-meter (1,100-foot) contour on Ladyface Mountain, and the majority of the *Dudleya cymosa* ssp. *ovatifolia* occurrences fall below that contour.

The "Agoura" form is scraped off roadside locations by City of Agoura Hills road crews every year as a casualty of the roadside weed abatement program.

#### 6. CONSERVATION EFFORTS

There are populations on public lands in Orange County on Modjeska Peak, in the Cleveland National Forest, and in Modjeska Canyon on County Park land. Populations also occur on public lands in the Santa Monica Mountains, on State Park land, and in Ventura County on Conejo Open Space Conservation Authority land. These populations are protected from development, but there are no management plans, for monitoring or protection of the taxa. See section G (page 34), for information on available conservation measures.

## F. *Dudleya verityi* (VERITY'S LIVE-FOREVER)

### 1. TAXONOMY

*Dudleya verityi* (Verity's dudleya) was described by Kei Nakai (1983) based on a collection he made in 1978 in Long Grade Canyon, Santa Monica Mountains, Ventura County. Raven and Thompson (1966) had assumed these plants to represent a southern extension of *D. farinosa*. During preparation of the 1977 revision of the flora, Dave Verity recognized these plants as representing a distinct species, and he subsequently encouraged Kei Nakai to review the taxonomy of the species..

### 2. DESCRIPTION

*Dudleya verityi* is unique among the *Dudleya* species discussed in this plan in that it forms multiple rosettes, as many as 100 per plant. Rosette leaves are 2 to 5 centimeters (0.8 to 2.0 inches) long and 5 to 8 millimeters (0.2 to 0.4 inch) wide. Floral stalks are 5 to 15 centimeters (2.0 to 5.9 inches) tall. Corollas are lemon yellow with petal tips recurved to 90 degrees.

### 3. LIFE HISTORY AND HABITAT

*Dudleya verityi* grows in a narrow band on north facing volcanic rock outcrops, along the lower slopes of the west end of the Santa Monica Mountains, in coastal sage scrub. Three species of concern (rare populations in decline) associated with *D. verityi* and coastal sage scrub habitat are Conejo buckwheat (*Eriogonum crocatum*), Blochman's liveforever (*D. blochmaniae* ssp. *blochmaniae*), and the coastal cactus wren (*Campylorhynchus bruneicapillus couesi*). An inventory of the north slope of Conejo Mountain documented a vascular flora of more than 240 species, and a lichen flora of more than 70 species. This constitutes an unusually high botanical richness compared to other areas with greater microclimate variation and substrate diversity (Wishner 1992). The diverse lichen flora associated with *Dudleya veritya* contains species that are considered rare, and disappearing from southern California, through habitat loss and air pollution (Riefner 1992). The cushion lichen, *Niebla ceruchooides*, appears to provide a nursery habitat for seed capture and germination for *Dudleya veritya*. The dense, intricately-branched cushion captures and consolidates moisture derived from soil and fog on the sheer rock

outcrops, providing suitable habitat for germination and establishment of *Dudleya veritya* (Riefner and Bowler 1995).

#### 4. DISTRIBUTION

*Dudleya veritya* is extremely limited in distribution, occurring in a discontinuous, narrow band 6.4 kilometers (4 miles) in length along the lower northern slope of Conejo Mountain and on north-facing volcanic outcrops in the vicinity of the Camarillo Hospital land (California State University, Channel Islands) (Table 6). Habitat between those locations is limited.

**TABLE 6. *Dudleya veritya* locations.**

NDDB Occurrence #	LOCATION	NUMBER OF INDIVIDUALS  (YEAR) (SITE TYPE) Current=C Historic=H	OWNER/ MANAGER
1	Long Grade Canyon	more than 1,000 (1989) C	Private
2	West Slope Conejo Mountain	report from the literature (1980) C	Private
3	North Slope Conejo Mountain	more than 10,000 (1992) C (including occurrence #2)	Private

NDDB: California Natural Diversity Database, California Department of Fish and Game

#### 5. REASONS FOR DECLINE AND THREATS

Historically, the lower slopes of Conejo Mountain have been the site for quarrying of construction-grade rock. There are abandoned, active, and proposed quarry operations within the distribution of *Dudleya veritya*. The majority of the distribution of *Dudleya veritya* is on privately owned lands in a region with rapidly increasing development. This is a major concern for this extremely rare species with such a limited distribution. Only a small portion of habitat is owned by a public agency (Ventura County Flood Control District).

Air quality problems are a threat to the lichen that provides a nursery for seedling establishment (Riefner 1992). Lichens are sensitive to air pollutants and have been eliminated from many areas during the past century (Hale 1983). Studies in southern California have shown a broad correlation between the increases in smog and the loss of the regional lichen flora (Sigal and Nash 1982). Fire that reduces or eliminates the lichen community could dramatically reduce the populations of *Dudleya veritya*. Lichens grow very slowly and persist for long periods of time (Hale 1983). The population structure of *Dudleya veritya* depends on mature lichen individuals. Fire would remove the necessary substrate for the species and modify *Dudleya veritya* habitat for an unspecified period of time. A recent fire that burned a mosaic pattern in the northern most portion of the species distribution will provide an opportunity to evaluate how serious the threat of fire is to *Dudleya veritya* habitat.

## 6. CONSERVATION EFFORTS

In 1992, a comprehensive survey was conducted on the northern slopes of Conejo Peak to identify appropriate sites for the establishment of a rare plant preserve (Wishner 1992). Suitable habitat for *Dudleya veritya* was found below the 274 meter (900-foot) contour. Some plants were, however, noted as high as 427 meters (1,400 feet) on vertical rock outcrops with a northerly aspect.

An extensive design was proposed for an ecosystem preserve to mitigate for loss of occupied *Dudleya veritya* habitat due to a project proposed by the Ventura County Flood Control District. The preserve was designed to include a significant portion of the unique floristic richness of Conejo Mountain. The future preserve would have been bounded by existing and approved developments within the City of Thousand Oaks and the Dos Vientos Ranch. Cost-sharing would have required cooperative acquisitions by local resource or conservation agencies, notably the City of Thousand Oaks, Conejo Open Space Conservation Authority, National Park Service, and the Santa Monica Mountains Conservancy (Wishner 1992). The proposal was never implemented as the project was modified to avoid impacts to the plant. The recommendations for this preserve design should, however, be pursued to provide protection for the highest quality site for the species. See section G (page 35) for information on available conservation measures.

## **G. AVAILABLE CONSERVATION MEASURES**

A number of tools are available to conserve the species addressed in this plan, although some have been utilized to a greater extent than others. Below is a summary of actions by Federal, State, County, and local agencies that have jurisdiction over lands supporting these species.

### **Federal**

#### **1. National Park Service**

Three of the plants (*Astragalus brauntonii*, *Pentachaeta lyonii*, and *Dudleya cymosa* ssp. *marcescens*) occur on Federal lands owned and managed by the Santa Monica Mountains National Recreation Area (SMMNRA). Their specific policies that address the conservation and management of listed species are as follows: National Park Service 77, General Management Plan, Land Acquisition Plan.

#### **2. U.S. Forest Service**

Although *Astragalus brauntonii* has not been found on Forest Service lands, the population in Monrovia is close to the Angeles National Forest. In 1991, surveys for *Astragalus brauntonii* were conducted on Cleveland National Forest lands above the Coal Canyon site. No plants of this species were found. Because the species is more evident after fires, there is still a chance, over time, that it may occur on National Forest land. *Dudleya cymosa* ssp. *ovatifolia* does occur on Cleveland National Forest lands. The Forest is conserving the species location according to their guidelines, policy, Forest Service Handbook direction (Forest Service Manual 2670), and the provisions of the Endangered Species Act. In addition to the possibility that additional occurrences of these species will be found on National Forest land in the future, the Forest Service could potentially play a role in the recovery of the species through its land adjustment program. This program may include any combination of the following activities: acquisitions, donations, and exchanges.

#### **3. U.S. Fish and Wildlife Service**

The Endangered Species Act of 1973, as amended (Act), requires the Service to develop a recovery plan that describes "site-specific management actions" necessary for the conservation and survival of these Los Angeles Basin plants.

The plan must have "objective, measurable criteria, which when met" will allow them to be removed from the Federal list of the threatened and endangered species. The plan must estimate the time and the cost needed to carry out the conservation measures. After a plant is removed from the list, the Fish and Wildlife Service must, in cooperation with the State of California, "effectively monitor for not less than 5 years" the taxon's status, and the Service must be prepared to restore the taxon to the list, if necessary. The Act also authorizes the Department of the Interior (Department) to acquire, if possible, habitat for preserving listed endangered species. The Act also requires Federal agencies to use their authorities to consult with the Service through section 7 requirements when a Federal action may affect federally listed species.

The Service is participating with the State and a number of local jurisdictions in the development of regional Natural Community Conservation Plans/Habitat Conservation Plans for Southern and Central/Coastal Orange County. *Dudleya cymosa* ssp. *ovatifolia* is covered by the Central/Coastal Plan where it occurs in Flemming Regional Park. The Park is within the plan's Reserve System boundary. A population in the Cleveland National Forest is outside the Reserve System. If new populations should be found in the North Ranch Policy Plan Area, or on private inholdings within the boundaries of the Cleveland National Forest in Black Star, Baker, Silverado, Williams, or Harding Canyons, the Service's section 10 permit for the Central/Coastal plan does not authorize any action leading to the loss of habitats. The Service found that the section 10 permit would not appreciably reduce the likelihood of the survival and recovery of *Dudleya cymosa* ssp. *ovatifolia* outside the reserve systems boundary. Additionally, the Central/Coastal plan treats *Astragalus brauntonii* as an "additional species of interest" because it is potentially located within the subregional plan study area. If future field surveys within the plan's proposed reserve system show that regulatory coverage is justified, *Astragalus brauntonii* will be added to the list of species covered by the plan. The Central/Coastal Plan also pledges to protect four habitat types to the extent that no additional mitigation or compensation would be required of participating landowners should any species dependent on the habitat be listed during the 75-year permit period. These habitat types include Tecate cypress forest, where *Astragalus brauntonii* might conceivably occur, cliff and rock, where *Dudleya cymosa* ssp. *marcescens* and *D. c.* ssp. *ovatifolia* might occur, plus chaparral (Coastal

subarea only), where there might be an outside chance of *A. brauntonii* being found.

### **State**

The California Environmental Quality Act (CEQA) provides some level of protection for endangered species on private lands through the environmental review process. Initially, a public agency reviews a project to determine whether it would negatively impact the species. If the impacts are not considered significant, a formal environmental impact report (EIR) is not required, and the project is granted a Negative Declaration with measures/recommendations to reduce environmental impacts. If the project's impacts are considered significant, a report is required, which consists of a description of existing project site conditions, impact analysis, and detailed mitigation measures that would reduce project impacts to a less-than-significant level. Mitigation measures that include avoidance, minimization, and compensation must be incorporated into the approved project, and may provide long-term species protection. 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. This State action does not supercede the Act and a section 10 permit would be required in order to comply with Federal requirements.

#### **1. California Department of Parks and Recreation**

The State Parks own and manage lands that support four of the species. Two species (*Astragalus brauntonii* and *Dudleya cymosa* ssp. *ovatifolia*) occur in Topanga State Park and two of the species (*Dudleya cymosa* ssp. *marcescens* and *Pentachaeta lyonii*) occur in Malibu Creek State Park. State Park policies include a directive "in concert with other agencies and organizations, to acquire and preserve outstanding examples of native California species; and to acquire and perpetuate significant natural plant communities, associations, and examples of rare, endangered, and endemic, or otherwise sensitive native

California plants, as indicated on State and Federal lists." (Calif. Park and Recreation Comm. 1994).

2. University of California Natural Reserve System (NRS)

the Natural Reserve System owns and manages a parcel in the Santa Monica Mountains (Stunt Ranch) that formerly supported a population of *Pentachaeta lyonii*. There is the possibility that with suitable conditions, the population will re-establish. Even though there are no specific directives regarding listed plants, the mission of the Natural Reserve System is to "contribute to the understanding and wise management of the earth, and its natural systems by supporting university-level teaching, research, and public service at protected natural areas throughout California" (NRS 1998).

3. Santa Monica Mountains Conservancy (SMMC)

The Conservancy is a State agency established to facilitate the acquisition of lands for Santa Monica Mountains National Recreation Area. The Comprehensive Plan gives priority to resource protection in the Conservation Element: "The natural resources of the Santa Monica Mountains should be protected. To the extent possible, all development should be compatible with this goal. Conflicts between development and natural resource values should be resolved by giving priority to protecting the resource unless benefits of overriding regional importance would otherwise be lost" (Santa Monica Mountains Comprehensive Planning Commission [SMMCPC] 1979). The Conservancy not only acts as an agent for transferring lands to the Recreation Area, but also owns land and manages parcels for other entities. *Pentachaeta lyonii* occurs on a parcel owned by the Metropolitan Water District and managed by the Conservancy. *Dudleya cymosa* ssp. *ovatifolia* occurs in close proximity on a parcel owned and managed by the Conservancy.

**County Agencies**

1. Los Angeles County

Four of the species (*Pentachaeta lyonii*, *Astragalus brauntonii*, *Dudleya cymosa* ssp. *ovatifolia*, and *Dudleya cymosa* ssp. *marcescens*) occur in Los Angeles County. The County has provisions for designating certain sites as Significant Ecological Areas (SEA); however, such designations are not permanent and are on private land and therefore are of limited importance as a conservation tool.



## 2. Orange County

Two of the species (*Astragalus brauntonii* and *Dudleya cymosa* ssp. *ovatifolia*) occur in Orange County.

## 3. Ventura County

All six of the species occur in Ventura County.

### **Other Local Jurisdictions**

#### 1. Conejo Open Space Conservation Authority (COSCA)

The Conservation Authority is a joint powers authority agency established between the City of Thousand Oaks and the Conejo Parks and Recreation District. While the Conejo Parks and Recreation District manages the smaller, more developed park units in and around the City of Thousand Oaks in Ventura County, the Conservation Authority acquires and manages the larger and undeveloped park units as open space. Two of the species (*Pentachaeta lyonii* and *Dudleya abramsii* ssp. *parva*) occur on lands managed by the Conservation Authority.

#### 2. Rancho Simi Parks and Recreation District (RSPRD)

Three of the species (*Astragalus brauntonii*, *Pentachaeta lyonii*, and *Dudleya abramsii* ssp. *parva*) occur on lands managed by the RSPRD. The agency focuses primarily on recreation, not habitat preservation.

#### 3. Incorporated Cities

In general, incorporated cities use the California Environmental Quality Act and California Endangered Species Act requirements when conducting impact analyses on sensitive species that occur on parcels within their jurisdiction. The Service reviewed the equivalent of a "conservation element" from the general plans of a number of cities that have planning and development jurisdiction over such parcels and found that the conservation of sensitive resources was addressed in only a general way, if at all. Exceptions were found in the general plans of two cities; these are noted as follows:

The hillside ordinance for the City of Agoura Hills limits grading to below the 335-meter (1,100-foot) contour on the north slope of Ladyface Mountain.

The Conservation Element from the general plan for the City of Thousand Oaks states that they "shall encourage and promote the preservation of all rare, threatened, endangered, or sensitive species listed by State and Federal agencies, the California Native Plant Society, and the City of Thousand Oaks" (City of Thousand Oaks 1996).

The general plan for the City of Westlake Village includes specific policies stating that they will "encourage new development projects to identify biological constraints and habitat linkages prior to project planning and site design," and will "pursue the voluntary dedication of open space or conservation easements to protect sensitive species and their habitats" (City of Westlake Village 1993).

## II. RECOVERY

### A. OBJECTIVES

The overall objective of implementing this recovery plan is to reclassify *Astragalus brauntonii* and *Pentachaeta lyonii* to threatened status, and eventually delist them, and to delist the four *Dudleya* species. Interim goals include (1) stabilizing and protecting populations (protection of current sites should target the largest possible blocks of land and should include a buffer of 150 meters (500 feet) to reduce external influences and allow expansion of populations), and (2) conducting research necessary to refine reclassification and recovery criteria.

### B. RECOVERY CRITERIA

*Astragalus brauntonii*-the species should be evaluated for reclassification to threatened when: (1) all current sites (including seedbanks) with the species are fully protected and managed with the primary intention of preserving the populations in perpetuity; (2) seed collected from all populations is stored at a certified Center for Plant Conservation botanical garden; and (3) reliable seed germination and propagation techniques for the species are understood. This species should be evaluated for delisting when populations are shown to be self-sustaining over a minimum of 15 years, or longer, because life history data shows that this species grows for 5 years and exists as seed banks from 15 to 95 years. The species probably maintains large seed banks so growing individuals are probably greatly outnumbered at any given time by dormant individuals in the form of seeds in the soil. One of the Endangered Species Act's requirements for delisting is a minimum of 5 additional years of monitoring, so delisted plants are assured an additional 5 years of protection under the Act.

*Pentachaeta lyonii* -the species should be evaluated for reclassification to threatened status when 10 populations of 10,000 or more plants from current sites are: (1) fully protected and managed with the primary intention of preserving the populations in perpetuity; (2) shown to be self-sustaining over a minimum of 15 years (or longer depending on whether the data continue to suggest large fluctuations in population size are characteristic of the species);

(3) seed collected from all populations is stored at a certified Center for Plant Conservation botanic garden; and (4) reliable seed germination and propagation techniques for the species are understood. The species should be evaluated for delisting when twice as many populations (20) meet the same criteria.

*Dudleya* species-the species could be considered for delisting when all current sites (including seedbanks) are: (1) fully protected and managed with the primary intention of preserving the populations in perpetuity; and (2) shown to be self-sustaining over a minimum of 10 years.

## **C. STEPDOWN NARRATIVE**

### **1. Protect and secure populations and habitat on unprotected lands.**

Habitat for the listed plants must be protected and secured in perpetuity, from identified threats of loss. Methods for securing lands include permanent conservation easements established through land use decisions, in-fee purchase, gifts of easement, or fee interest by property owner.

#### **1.1 Protect habitat and populations through lead agency implementation of authorities.**

The primary lead agencies that regulate land uses for unprotected populations and habitats are city and county governments. For this reason, their involvement in any future recovery planning is very important. Lead agencies under the California Environmental Quality Act, existing county and city ordinances, and the California Endangered Species Act can approve development projects that allow economic use of private property, while providing necessary protection for the needs of these listed species. If the species in this plan are to recover, city and county agencies must require onsite protection because there are no effective methods to create offsite populations. Where adjacent, multiple jurisdictions or development proposals occur, coordination between the planning agencies will maximize the protection of listed species by providing for contiguous areas of protected habitat. Lead agencies should review successful project approvals (e.g. required

mitigation monitoring to evaluate the effectiveness of proposed project mitigation measures) and use these as examples for future projects.

Fee title land acquisition, conservation easements, long-term leases, cooperative agreements, and plans should be negotiated with willing public and private landowners through purchase, donation, transfer, exchange, or written agreement. Lands could also be conveyed to the U.S. Fish and Wildlife Service from landowners to meet mitigation, zoning, or land-use permit requirements. Protected lands must be ecologically viable.

Conservation easements may also be used to protect habitat while allowing it to remain in private ownership. Cooperative agreements and coordinated planning and management efforts could assist in conservation efforts.

## **1.2 Conduct biological constraints analysis.**

A biological constraints analysis is the gathering and interpretation of information on the distribution of sensitive biological resources prior to project design to prevent land use conflicts. Constraints analysis should precede the preparation of plans to develop lands with potential habitat for the listed species. Constraints analysis for these six species should precede any geotechnical analysis because the geological evaluation of soil stability involves significant soil disturbance. This disturbance can alter a site's habitat capability to provide for the persistence of listed species and destroy the plants themselves. As a result, a biological constraints analysis is needed to prevent damage from geotechnical analysis. Constraints analysis is a lead agency obligation; it is included in the initial study analysis and precedes recordation of tract maps. Development of a biological constraints analysis would involve thorough surveys for the listed species (see task 3) to allow maximum protection through project design with preserves, buffers, and conservation easements. Calcareous soil surveys would be appropriate for dormant *Astragalus brauntonii* populations (seedbanks).

### **1.3 Landowner contact.**

For private lands reported to have any of the listed species, landowners should be contacted and provided with information about available conservation mechanisms, such as conservation easements, management agreements, or purchase where there are willing sellers. (see task 5).

### **1.4 Establish rare plant reserves.**

Rare plant reserves should be designed to include adequate space for plant populations to persist through dispersal within immediate areas of suitable habitat. For example, the annual *Pentachaeta lyonii* will dominate different portions of appropriate habitat over the course of several years. A properly designed, protected habitat will also include unoccupied potential habitat for plants to disperse within any given year. In addition to providing enough space for plant populations to disperse, protected habitats must provide buffers against the adverse effects of adjacent development. This includes effects such as altered soil moisture conditions, enhanced weed establishment, and/or other factors that result in degraded site quality. Additionally, buffers should support habitat required for pollinators, an important factor for *P. lyonii*. Development adjacent to wildland habitat will require buffers for fire clearance. Buffer zones for fire control purposes should include adequate distance from modified habitat. Fuels modification requirements for insurance purposes is potentially as much as 90 meters (300 feet) from dwellings. An additional buffer of 60 meters (200 feet) would permit the habitat integrity needed for a combination of rare plant and pollinator requirements. Plans that have already been developed (e.g., mitigation plans for *Astragalus* and *Dudleya verityi*) should be incorporated into conservation actions for those species.

## **2. Manage and monitor protected areas.**

The process of evaluating past and current management and making adjustments as needed is termed "adaptive management." Public and private conservation

lands should be adaptively managed to maximize their potential to support listed species and their habitats.

### **2.1 Implement appropriate management in occupied habitat.**

Management plans should be developed and implemented for areas that harbor any of the six listed species. If new threats are identified, or other new information becomes available, then management plans need to be re-evaluated and/or revised. Management activities should be evaluated periodically and adjusted to maximize the potential for survival, conservation, and recovery of listed species. Results of new biological research should be considered in adaptive management schemes (see research task 4).

### **2.2 Develop and implement monitoring plans for all populations.**

Land management agencies, which administer lands occupied by any of the six species listed in this plan, should develop and implement long-term, permanent monitoring plans. Monitoring should include; plant abundance of listed species, site integrity, and documentation of existing/potential threats. The populations should be monitored every 3 years, to determine trends in population characteristics and threats. Occurrences should be continually monitored (current and future sites). Monitoring should be done for all other possible populations, regardless of whether management plans have been developed or formal protection has been secured. The Service and the California Department of Fish and Game plant ecologist for the region will evaluate the monitoring reports.

## **3. Survey historic locations and other potential habitat where species in the plan may occur.**

Surveys of the potential albeit limited, habitat within each of the six species range should be done. Several California Natural Diversity Database occurrence records for the listed species are represented only by observations. Information on population status, threats, and

abundance is also needed for these sites. Information gathered from the additional details will be used to provide lead agencies to determine protective land use designation for the listed plant species in this plan. Data gathered will assist in determining the range of site characteristics, population vigor, and species viability to help establish minimum population standards for rare plant reserves (task 1.4), and consequently, for recovery.

### **3.1 Establish a survey program and follow protocols for surveys.**

The Service will coordinate a cooperative program with head agencies and interested parties to conduct surveys for the six listed species. Protocols for conducting and reporting botanical inventories for federally listed, proposed, and candidate plants are found in Appendix A.

### **3.2 Conduct general and directed surveys.**

A survey and population census for each species needs to be conducted with the permission of landowners. General surveys of potential habitat and directed surveys of historic locations are needed on remaining potential habitats, throughout the distribution of the species. Results should be provided to the Service, to be incorporated into the recovery program.

**3.2.1 Surveys for *Astragalus brauntonii*** are needed in: 1) the Simi Hills in the vicinity of Oak Park and Morrison Homes to clarify the remaining habitat for protection; to the east, in the reported sites from Dayton Canyon and the Silvernale Ranch in the jurisdictions of Los Angeles and Ventura Counties; 2) the Santa Monica Mountains, in the Santa Ynez Canyon region, west to the city of Malibu; 3) the undeveloped lands in the city of Monrovia, in the vicinity of Clamshell Canyon and to the east; and 4) in the north end of the Santa Ana



Mountains, in the County of Orange, the City of Anaheim, and the Chino Hills region.

- 3.2.2**     **Surveys for *Pentachaeta lyonii*** are needed throughout its range, specifically: 1) the western portion of the City of Simi Valley, adjacent lands of Ventura County, and the city of Moorpark; 2) the undeveloped lands of the City of Thousand Oaks and adjacent Ventura County; 3) the undeveloped lands of the City of Westlake Village and adjacent Ventura County; 4) the undeveloped lands in the southern portion of the city of Agoura Hills and adjacent Los Angeles County; 5) the central Santa Monica Mountains in Ventura and Los Angeles Counties; and 6) the historic localities of Palos Verdes Peninsula and Santa Catalina Island.
- 3.2.3**     **Surveys for *Dudleya abramsii* ssp. *parva*** are needed from the Conejo Grade to the City of Simi Valley, including the jurisdictions of the County of Ventura, City of Thousand Oaks, City of Moorpark, and the City of Simi Valley.
- 3.2.4**     **Surveys for *Dudleya cymosa* ssp. *marcescens*** are needed in the central Santa Monica Mountains in Los Angeles and Ventura Counties.
- 3.2.5**     **Surveys for *Dudleya cymosa* ssp. *ovatifolia*** are needed for the central Santa Monica Mountains in Los Angeles County, the City of Westlake, the City of Agoura Hills, the City of Malibu, the vicinity of Topanga, and in Orange County in the northern Santa Ana Mountains.
- 3.2.6**     **Surveys for *Dudleya verityi*** are needed in Ventura County from the Conejo grade to the vicinity of Round Mountain/Long Grade Canyon.

**4. Conduct biological and ecological research to define life history strategies and population dynamics to guide recovery/conservation efforts.**

A better understanding of the population dynamics and identification of ecological factors that may be affecting those dynamics are needed to develop appropriate management plans to recover the six plant species.

**4.1 Research needs for *Astragalus brauntonii*.**

Demographic studies are needed to identify limiting factors within the life history of *Astragalus brauntonii*. Subjects for population characteristic studies may include, the influence of disturbance on seedling establishment, soil seed bank (viable seed condition in the soils of occupied habitat), metapopulation dynamics (how the various sites are interrelated), and dispersal mechanisms (to understand potential distribution), including the role of herbivory, pollinators, and vectors in reproduction. Disturbance to habitats and populations of *Astragalus brauntonii* caused by fire and non-native species should be studied to determine their degree of influence on recovery. This includes fire management requirements, soil characteristics (pH, texture, hydrology, slope, etc.), soil distribution (limited pockets of calcareous soils), and techniques that maintain habitat openings to provide ecological stability. This information should help to define management goals and priorities for sites with *Astragalus brauntonii* habitat.

**4.2 Research needs for *Pentachaeta lyonii***

Studies for *Pentachaeta lyonii* are needed on population characteristics (to identify limiting life history stages) including; the influence of disturbance on seedling establishment, soil seed bank, metapopulation dynamics, and dispersal mechanisms to understand potential distribution. Research is required to identify insect pollinators and their habitat management (ensuring adequate habitat protection for perpetuity). Competition studies on *Pentachaeta lyonii* and non-native

weeds are also needed. Furthermore, the development and study of techniques to maintain habitat openings will help to provide ecological stability.

#### **4.3 Research needs for the *Dudleya* species.**

Studies for the *Dudleya* species are needed on population characteristics, soil seed bank, metapopulation dynamics, identification for potential unoccupied habitat, dispersal mechanisms to understand potential distribution, and effects of fire frequencies on persistence of populations. Also, identification of pollinators and their habitat requirements (ensuring adequate habitat is protected for perpetuity). Research on the effects of air pollution on lichen species associated with *Dudleya verityi* will also be important.

#### **4.4 Develop techniques to artificially enhance or introduce *Astragalus brauntonii* and *Pentachaeta lyonii*.**

Restoration and reintroduction of *Astragalus brauntonii* and *Pentachaeta lyonii* may be necessary to expand the current ranges of these endemic species. These techniques for artificial enhancement, repatriation, and/or introduction reduce the risk of extinction from random disturbance and natural events. Artificially collected seed and propagated plants can provide potential material for enhancing existing populations by repatriating plants to former sites and/or introducing plants to new sites. Rancho Santa Ana Botanic Garden has conducted preliminary work on germination and growth techniques for both species, and should continue in these efforts. Experimental introductions of these species into appropriate habitats (i.e. calcic soils for *Astragalus*) should be monitored to elucidate if this is an appropriate recovery technique for these species.

**4.5 Collect, store and develop seed banking techniques for *Astragalus brauntonii* and *Pentachaeta lyonii*.**

Seed banking is a prudent life strategy for endangered species such as *Astragalus brauntonii* and *Pentachaeta lyonii* that exist in only a few locations. This strategy helps to guard against chance catastrophic disturbance, which often occurs in source populations of these species. Detailed guidelines for seed collection have been published by the Center for Plant Conservation (1991). Rancho Santa Ana Botanic Garden is the local seed storage facility for southern California. An agreement that ensures long term storage and seed banking needs to be implemented with this facility. Funding for these activities should be sought from sponsors of projects that may affect the listed species covered by this plan.

**5. Develop outreach plans to conserve the species in this plan.**

Outreach is an important component of implementing this recovery plan. This plan should be developed to enhance the public's understanding of issues related to conservation and recovery of the six listed species. Participation from both public and private entities should be encouraged for the establishment of conservation plans for the six listed species.

### **5.1 Develop plans for private lands.**

A plan should be developed to provide factual information on the recovery process for the six listed plant species to interested and affected land owners. An emphasis on outreach should be with landowners who have reported or potential populations of the six listed plant species in this recovery plan. For private lands with potential populations of listed species, permission should be sought to conduct on-site surveys (see task 3.2). If surveys identify populations of listed species, landowners should be informed of their significance and offered incentives to continue current land uses that support listed species habitat (see tasks 1 and 3). Permission for seed collection should also be discussed with these landowners as many of the six plant species seedbanks can remain dormant in fire suppressed areas.

### **5.2 Develop protected lands plans.**

Local land management agencies such as National Park Service, Conejo Open Space Conservation Authority, and California Department of Parks and Recreation should develop outreach material (perhaps including exhibits) to educate the user groups recreating on public lands which harbor the six listed species in this recovery plan.

### **5.3 Develop lead agency plans.**

Land development and planning agencies should develop internal programs to educate agency personnel on the significance of the six listed plant species, and the various laws and policies that provide for their protection.

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#### IV. IMPLEMENTATION SCHEDULE

The schedule that follows is a summary of actions and estimated costs for this recovery plan. It is a guide to meet the objectives of the recovery plan as elaborated in Part II, Narrative Section. This schedule indicates task priorities, task numbers, task descriptions, duration of tasks, the responsible agencies, and lastly, estimated costs. These actions, when accomplished, should bring about the recovery of the taxa and protect their habitats. It should be noted that the estimated monetary needs for some tasks remain to be determined, and therefore, reflects an incomplete estimate of financial requirements for the recovery of the taxa.

##### Definitions and Acronyms Used:

Priorities in column one of the implementation schedule are assigned as follows:

- 1- An action which *must* be taken to prevent extinction or to prevent the species from declining irreversibly in the *foreseeable* future.
- 2- An action which must be taken to prevent a significant decline in species' population/habitat quality, or some other significant negative impact short of extinction.
- 3- All other actions necessary to provide for full recovery of the species.

Task durations are the number of years estimated to accomplish the task. "Continuous" indicates that the task will be implemented on a continuing basis once it is begun. "Ongoing" indicates that the task has been implemented and will continue until no longer necessary for recovery.

##### **Key to Acronyms:**

BRD--U.S. Geological Survey Biological Research Division

CDFG--California Department of Fish and Game

FWS--U.S. Fish and Wildlife Service

LEAD AGENCY --Agencies with land use permitting authorities

RSABG-- Rancho Santa Ana Botanic Garden

\*agency responsibility for taking the lead on the task

Implementation Schedule for Six Plant From the Mountains Surrounding the Los Angeles Basin.

PRIORITY #	TASK #	TASK DESCRIPTION	TASK DURATION (YEARS)	RESPONSIBLE PARTY	ESTIMATED COST, thousands of dollars, by fiscal year.					COMMENTS and costs for fiscal years 2004-2010	
					TOTAL COST	2000	2001	2002	2003		2004
<b>Need 1: Protect and secure occurrences</b>											
1	1.1	Protect habitat and occurrences through lead agency implementation of authorities	Ongoing	Lead agency *CDFG *FWS	50	10	10	10	10	10	Cost will vary with level of development activity
1	1.2	Conduct constraints analysis	Continuous	Lead agency *CDFG *FWS	50	10	10	10	10	10	Cost will vary with level of development activity
1	1.3	Land owner contact	Ongoing	CDFG FWS	50	10	10	10	10	10	to be determined
1	1.4	Establish rare plant reserves	10	Lead agency *Landowners *CDFG *FWS	50	10	10	10	10	10	to be determined
<b>Need 1 subtotal cost</b>					<b>200</b>	<b>40</b>	<b>40</b>	<b>40</b>	<b>40</b>	<b>40</b>	
<b>Need 2: Manage and monitor protected areas</b>											

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Implementation Schedule for Six Plant From the Mountains Surrounding the Los Angeles Basin (continued).

PRIORITY #	TASK #	TASK DESCRIPTION	TASK DURATION (YEARS)	RESPONSIBLE PARTY	ESTIMATED COST, thousands of dollars, by fiscal year.					COMMENTS and costs for fiscal years 2004-2010	
					TOTAL COST	2000	2001	2002	2003		2004
2	2.1	Implement appropriate management in occupied habitats	Continuous	Lead agency *Landowners *CDFG * FWS	60	20	10	10	10	10	to be determined
2	2.2	Develop and implement monitoring plans for all occurrences	Continuous	Lead agency *Landowners *CDFG * FWS	50	10	10	10	10	10	10/year
<b>Need 2 subtotal cost:</b>					<b>110</b>	<b>30</b>	<b>20</b>	<b>20</b>	<b>20</b>	<b>20</b>	
<b>Need 3: Survey historic locations and other potential habitat where species in the plan may occur</b>											
2	3.1	Establish a survey program, and follow protocols, for surveys	1	Lead agency *Landowners *CDFG * FWS	5	5	0	0	0	0	
2	3.2.1	Surveys for <i>Astragalus brauntonii</i>	10+	*CDFG *FWS	50	10	10	10	10	10	10/year
2	3.2.2	Surveys for <i>Pentachaeta lyonii</i>	10+	CDFG FWS	50	10	10	10	10	10	10/year

Implementation Schedule for Six Plant From the Mountains Surrounding the Los Angeles Basin (continued).

PRIORITY #	TASK #	TASK DESCRIPTION	TASK DURATION (YEARS)	RESPONSIBLE PARTY	ESTIMATED COST, thousands of dollars, by fiscal year.					COMMENTS and costs for fiscal years 2004-2010	
					TOTAL COST	2000	2001	2002	2003		2004
2	3.23	Surveys for <i>Dudleya abramsii</i> ssp. <i>parva</i>	10+	CDFG FWS	50	10	10	10	10	10	10/year
2	3.24	Surveys for <i>Dudleya cymosa</i> sp. <i>marcescens</i>	10+	CDFG FWS	50	10	10	10	10	10	10/year
2	3.25	Surveys for <i>Dudleya cymosa</i> ssp. <i>ovatifolia</i>	10+	CDFG FWS	50	10	10	10	10	10	10/year
2	3.26	Surveys for <i>Dudleya verityi</i>	10+	CDFG FWS	50	10	10	10	10	10	to be determined
<b>Need 3 Subtotal Cost:</b> .....					<b>305</b>	<b>65</b>	<b>60</b>	<b>60</b>	<b>60</b>	<b>60</b>	
<b>Need 4: Conduct biological and ecological research</b>											
2	4.1	<i>Astragalus brauntonii</i> research	5	BRD CDFG FWS	170	50	50	30	30	10	
		<i>Pentachaeta lyonii</i> research	5	BRD CDFG FWS	170	50	50	30	30	10	

Implementation Schedule for Six Plant From the Mountains Surrounding the Los Angeles Basin (continued).

PRIORITY #	TASK #	TASK DESCRIPTION	TASK DURATION (YEARS)	RESPONSIBLE PARTY	ESTIMATED COST, thousands of dollars, by fiscal year.					COMMENTS and costs for fiscal years 2004-2010	
					TOTAL COST	2000	2001	2002	2003		2004
		<i>Dudleya</i> species research	5	BRD CDFG FWS	230	80	80	30	30	10	
2	4.4	Develop techniques to undertake artificial enhancement or introduction efforts for <i>Astragalus brauntonii</i> and <i>Pentachaeta lyonii</i>	3	RSABG	60	30	20	10			
2	4.5	Collect, store, and develop seed bulking techniques for <i>Astragalus brauntonii</i> and <i>Pentachaeta lyonii</i>	Ongoing	RSABG	187	7	5	2	2	2	
<b>Need 4 Subtotal Cost:</b>					<b>648</b>	<b>217</b>	<b>205</b>	<b>102</b>	<b>92</b>	<b>32</b>	

Implementation Schedule for Six Plant From the Mountains Surrounding the Los Angeles Basin (continued).

PRIORITY #	TASK #	TASK DESCRIPTION	TASK DURATION (YEARS)	RESPONSIBLE PARTY	ESTIMATED COST, thousands of dollars, by fiscal year.					COMMENTS and costs for fiscal years 2004-2010	
					TOTAL COST	2000	2001	2002	2003		2004
<b>Need 5: Develop outreach plans to conserve the species in this plan</b>											
3	5.1	Develop private lands plan	ongoing	Lead agency *FWS *CDFG	25	5	5	5	5	5	to be determined
3	5.2	Develop protected lands plans	ongoing	Lead agency *FWS *CDFG	25	5	5	5	5	5	to be determined
3	5.3	Develop lead agency plans	ongoing	Lead agency *FWS *CDFG	25	5	5	5	5	5	to be determined
		<b>Need 5 subtotal cost:</b>			<b>75</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>	



Implementation Schedule for Six Plant From the Mountains Surrounding the Los Angeles Basin (continued).

PRIORITY #	TASK #	TASK DESCRIPTION	TASK DURATION (YEARS)	RESPONSIBLE PARTY	ESTIMATED COST, thousands of dollars, by fiscal year.					COMMENTS and costs for fiscal years 2004-2010	
					TOTAL COST	2000	2001	2002	2003		2004
<b>TOTAL COST for first 5 years</b> .....					<b>1,338</b>	<b>357</b>	<b>330</b>	<b>227</b>	<b>217</b>	<b>157</b>	Ongoing needs over the 20 years targeted for recovery will result in higher totals than shown in this table.

## APPENDIX A

### **Guidelines for Conducting and Reporting Botanical Inventories for federally Listed, Proposed and Candidate Plants**

These guidelines describe protocols for conducting botanical inventories for federally listed, proposed, and candidate plants, and they describe minimum standards for reporting results. The Service will use, in part, the information outlined below in determining whether the project under consideration may affect any listed, proposed, or candidate plants, and in determining the direct, indirect, and cumulative effects.

Field inventories should be conducted in a manner that will locate listed, proposed, or candidate species (target species) that may be present. The entire project area requires a botanical inventory, except developed agricultural lands. The field investigator(s) should:

1. Conduct inventories at the appropriate times of year when target species are present and identifiable. Inventories will include all potential habitats. Multiple site visits during a field season may be necessary to make observations during the appropriate phenological stage of all target species.
2. If available, use a regional or local reference population to obtain a visual image of the target species and associated habitat(s). If access to reference populations(s) is not available, investigators should study specimens from local herbaria.
3. List every species observed and compile a comprehensive list of vascular plants for the entire project site. Vascular plants need to be identified to a taxonomic level which allows rarity to be determined.
4. Report results of botanical field inventories that include:
  - a. A description of the biological setting, including plant community, topography, soils, potential habitat of target species, and an evaluation of environmental conditions, such as timing or quantity of rainfall, which may influence the performance and expression of target species.
  - b. A map of project location showing scale, orientation, project boundaries, parcel size, and map quadrangle name.

- c. Survey dates and survey methods.
  - d. If a reference population is available, provide a written narrative describing the target species reference population(s) used, and date(s) when observations were made .
  - e. A comprehensive list of all vascular plants occurring on the project site, for each habitat type.
  - f. Current and historic land uses of the habitat(s) and degree of site alteration .
  - g. Presence of target species off-site on adjacent parcels.
  - h. An assessment of the biological significance or ecological quality of the project site in a local and regional context .
5. If target species is(are) found, report results that additionally include:
- a. a map showing federally listed, proposed, and candidate species distribution as they relate to the proposed project.
  - b. If target species is (are) associated with wetlands, a description of the direction and integrity of flow of surface hydrology. If target species is (are) affected by adjacent off-site hydrological influences, describe these factors.
  - c. The target species phenology and microhabitat; an estimate of the number of individuals of each target species per unit area; identify areas of high, medium and low density of target species over the project site; and provide acres of occupied habitat of target species. Investigators could provide color slides, photos or color copies of photos of target species or representative habitats to support information or descriptions contained in reports.
  - d. The degree of impact(s), if any, of the proposed project as it relates to the potential unoccupied habitat of target habitat.
6. Document findings of target species by completing California Native Species Field Survey Form(s) and submit form(s) to the Natural Diversity Data Base. Documentation of determinations and/or voucher specimens may be useful in cases of taxonomic ambiguities and habitat or range extensions.
7. Report, as an addendum to the original survey, any change in abundance and distribution of target plants in subsequent years. Project sites with inventories older

than 3 years from the current date of project proposal submission will likely need additional survey.

8. Adverse conditions may prevent investigator(s) from determining presence or identifying some target species in potential habitat(s) of target species. Disease, drought, predation, or herbivory may preclude the presence or identification of target species in any year. An additional botanical inventory(ies) in a subsequent year(s) may be required if adverse conditions occur in a potential habitat(s). Investigator(s) may need to discuss such conditions.

## Appendix B

### Summary of the Agency and Public Comments on the Draft Recovery Plan for Six Plants from the Mountains Surrounding the Los Angeles Basin

On January 6, 1999, the Service released the Draft Recovery Plan for Six Plants from the Mountains Surrounding the Los Angeles Basin for a 90 day comment public period that ended April 6, 1999 (64 **Federal Register** 906).

Nine responses were received, each containing varying numbers of comments. All comments either provided additional information or corrections. The Service sent letters to three people considered experts with these taxa to solicit comments on the Draft Recovery Plan. Responses were received from one of these experts, who provided comments and recommendations. The Service reviewed all of the comments received during the comment period. Comments received were positive, favorable, and in support of the goal and approach taken. The comments provide recommendations for research/conservation strategies, and correct and updated specific locality descriptions and information. All applicable comments have been addressed in, or incorporated into the body of the final Recovery Plan.

#### **The number of letters received by affiliation:**

Federal agencies	2 letters
Conservation organizations	1 letter
Private individuals	6 letters