Dudleya stolonifera
(Laguna Beach liveforever)

5-Year Review:
Summary and Evaluation

Dudleya stolonifera **(Laguna Beach liveforever) habitat. Photo credit Todd Archer, (USFWS).**

Dudleya stolonifera **(Laguna Beach liveforever). Photo credit Todd Archer, (USFWS).**

Dudleya stolonifera **(Laguna Beach liveforever). Photo credit Wayne D. Johnson.**

U.S. Fish and Wildlife Service
Carlsbad Fish and Wildlife Office
Carlsbad, CA

April 16, 2010

5-YEAR REVIEW
Dudleya stolonifera (Laguna Beach liveforever)

I. GENERAL INFORMATION

Purpose of 5-Year Reviews:

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

Species Overview:

Dudleya stolonifera (Laguna Beach liveforever) is a succulent member of Crassulaceae (stonecrop family). It has basal rosettes of flat, oblong, bright green leaves arising from a woody base; its flowers have bright yellow-green petals that are fused near their base. This perennial is distinguished by its branching stolons (horizontal stems that root at the nodes) and floral stems that arise 8 to 25 centimeters (cm) (3.2 to 9.8 inches (in)) from a wide basal rosette (Moran 1960, p. 358). *Dudleya stolonifera* is a narrow endemic found only in six occurrences, all on north-facing sandstone surfaces in steep-walled canyons near Laguna Beach, Orange County, California (CDFG 1987, p. 1). Three of these occurrences are on lands managed by Orange County Parks, two are on private lands, and one is on land owned by the City of Laguna Beach (CNDDB 2010a).

Dudleya stolonifera was listed as threatened under the California Endangered Species Act (CESA) in 1987 and as threatened under the Act in 1998.

Methodology Used to Complete This Review:

This review was prepared by Todd Archer at the Carlsbad Fish and Wildlife Office, following the Region 8 guidance issued in March 2008. We used survey information from experts who have been monitoring various known occurrences of *Dudleya stolonifera* and the California Natural Diversity Database (CNDDB) maintained by the California Department of Fish and Game (CDFG). We received no information relative to *Dudleya stolonifera* from the public in response to our Federal Notice initiating this 5-year review. This 5-year review contains updated

information on the species' biology and threats, and an assessment of information compared to that known at the time of listing or since the last 5-year review. We focus on current threats to the species pursuant to the Act's five listing factors. This review synthesizes this information to evaluate the listing status of the species and provide an indication of its progress towards recovery. Finally, based on this synthesis and the threats identified in performing the five-factor analysis, we herein recommend a prioritized list of conservation actions to be completed or initiated within the next 5 years.

Contact Information:

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Lead Field Office: Todd Archer, Fish and Wildlife Biologist; Bradd Baskerville-Bridges, Recovery Branch Chief; Carlsbad Fish and Wildlife Office; (760) 431-9440.

Federal Register (FR) Notice Citation Announcing Initiation of This Review:

A notice announcing initiation of the 5-year review of this taxon and the opening of a 60-day period to receive information from the public was published in the Federal Register on March 25, 2009 (USFWS 2009, p. 12878). No information was received during the open period; however, one response was received on June 1, 2009, from the Department of the Navy (H.R. Hering, California, Department of the Navy, 2009, *in litt.*). This response contained no information relevant to the taxon being reviewed here and will not be considered further.

Listing History:

Original Listing
FR Notice: 63 FR 54938
Date of Final Listing Rule: October 13, 1998
Entity Listed: *Dudleya stolonifera* (Laguna Beach liveforever), a plant species
Classification: Threatened

State Listing
Dudleya stolonifera was listed by the State of California as threatened in 1987.

Associated Rulemakings: None

Review History: None

Species' Recovery Priority Number at Start of 5-Year Review:

The recovery priority number for *Dudleya stolonifera* is 8 according to the Service's 2009 Recovery Data Call for the CFWO, based on a 1-18 ranking system where 1 is the highest-ranked recovery priority and 18 is the lowest (USFWS 1993, pp. 43098–43105). This number indicates the species faces a moderate degree of threat and has a high potential for recovery.

Recovery Plan or Outline: No recovery plan or outline has been prepared for *Dudleya stolonifera*.

II. REVIEW ANALYSIS

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

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

Information on the Species and its Status:

Species Biology and Life History

Figure 1. *Dudleya stolonifera* (Laguna Beach liveforever) in Laguna Laurel Canyon. Photo credit Todd Archer (USFWS).

Dudleya stolonifera is a succulent perennial with leaves 1.5 to 3 cm (0.6 to 1.2 in) thick and 10 cm (4 in) long in basal rosettes (Roberts 1995, p. 1). *Dudleya stolonifera* is the only *Dudleya* characterized by lateral branches (stolons). The stolons rise from axils of lower rosette leaves, terminate in smaller rosettes, grow up to 5 cm (2 in) long, and are 3 to 8 millimeters (mm) (0.1 to 0.3 in) thick (Moran 1977, p. 1). The rosettes are made up of 12 to 25 bright green leaves that are 1.5 to 3 cm (0.6 to 1.2 in) wide, 3 to 7 cm (1.2 to 2.8 in) long, and 3 to 4 mm (0.11 to 0.16 in) thick (Moran 1977, p. 1). During late spring and early summer (May to July), a flowering stalk grows up to 20 cm (8 in) tall. Each stalk develops between 3 and 9 short, tubular yel1ow flowers that are 7 to 15 mm (0.25 to 0.6 in) long (Roberts 1997, p. 1; Thomson 1993, p. 104).

Little is known of the reproductive strategies of *Dudleya stolonifera*. The tubular yellow flowers found in *D. stolonifera* are similar to the flowers of other *Dudleya* species that are known to be self-fertilizing. This similarity suggests some degree of self-pollination may occur in *D. stolonifera*. Nectar at the flower base is accessible to small bees and flies that are able to crawl into the flowers and to larger insects with moderately long hypopharynxes (mouth part resembling a tongue) (Levin and Mulroy 1985, p. 57). Bees in the genera *Bombus* and *Anthophora* have been identified as important pollinators of other *Dudleya* (Moldenke 1976, p. 325).

Spatial Distribution

Dudleya stolonifera was historically found only in Orange County, California. At listing, the species was found in six occurrences near Laguna Beach (USFWS 1998, p. 54939). Historical occurrences were restricted between Laguna Canyon to the north and Aliso Canyon to the south, an area of approximately 10 square kilometers (sq. km.) (3.9 square miles (sq. mi.) (Figure 2; Appendix 1). The type locality is Aliso Canyon (Element Occurrence (EO) 2) with occurrences historically found in several areas near the canyon mouth. Approximately 7 km (4.4 mi) to the north up the Aliso Creek watershed, an occurrence was recorded in Mathis Canyon (EO 7). Laguna Canyon was historically home to four occurrences; from the canyon mouth, occurrences were discovered at Canyon Acres (EO 5), Lateral Canyon B (EO 6), Big Bend (EO 1), and Laguna Laurel Canyon (EO 4) (CNDDB 1997, p. 1). Since listing, no new occurrences have been reported. All six of the historical occurrences are considered extant.

Three additional occurrences reported in CNDDB (CNDDB 2010a) are in question based on inadequate documentation. Occurrences in Cactus Canyon (EO 8), Alta Laguna (EO 9), and Temple Hill West (EO 10) were reported in 1985, but were not included in the listing rule. These occurrences are not vouchered, photographically verified, or otherwise documented. Repeated surveys at these locations has failed to find *Dudleya stolonifera* (F. Roberts, consulting biologist, pers. comm. 2010a; Marsh 1983, p. 3). The spatial data gathered by CNDDB suggests *D. multicaulis* location data (EO 5, 25, 27) may have also been transcribed in error to *D. stolonifera* (CNDDB 2010b, pp. 5, 22, 24). Occurrence modification reports requesting removal of these three EOs are being compiled for submission to CNDDB (Roberts, pers. comm. 2010b).

Abundance

At listing, six known occurrences of *Dudleya stolonifera* were reported to support up to approximately 8,000 to 10,000 individual standing plants (USFWS 1998, p. 54946). About 2,000 *D. stolonifera* individuals were reported in Aliso Canyon (EO 2) (CNDDB 2010a, p. 2). Another 2,000 to 3,000 plants occurred in the Big Bend area (EO 1) of Laguna Canyon. The Laguna Laurel Canyon occurrence (EO 4) was reported to have had about 2,600 individuals (Roberts 1995, p. 1). Two additional occurrences, Canyon Acres (EO 5) and Lateral Canyon B (EO 6), numbered less than 100 plants each.

Since listing, we discovered that the Mathis Canyon (EO 7) count made in 1992 by Karlin Marsh reported 20,000 individuals (CNDDB 2010a, p. 7). This count was unknown to the Service at listing and increases the known abundance of *Dudleya stolonifera* to approximately 30,000 standing plants. This is the largest occurrence of *D. stolonifera*, and accounts for 67 percent of individual plants rangewide (Roberts, pers. comm. 2009a).

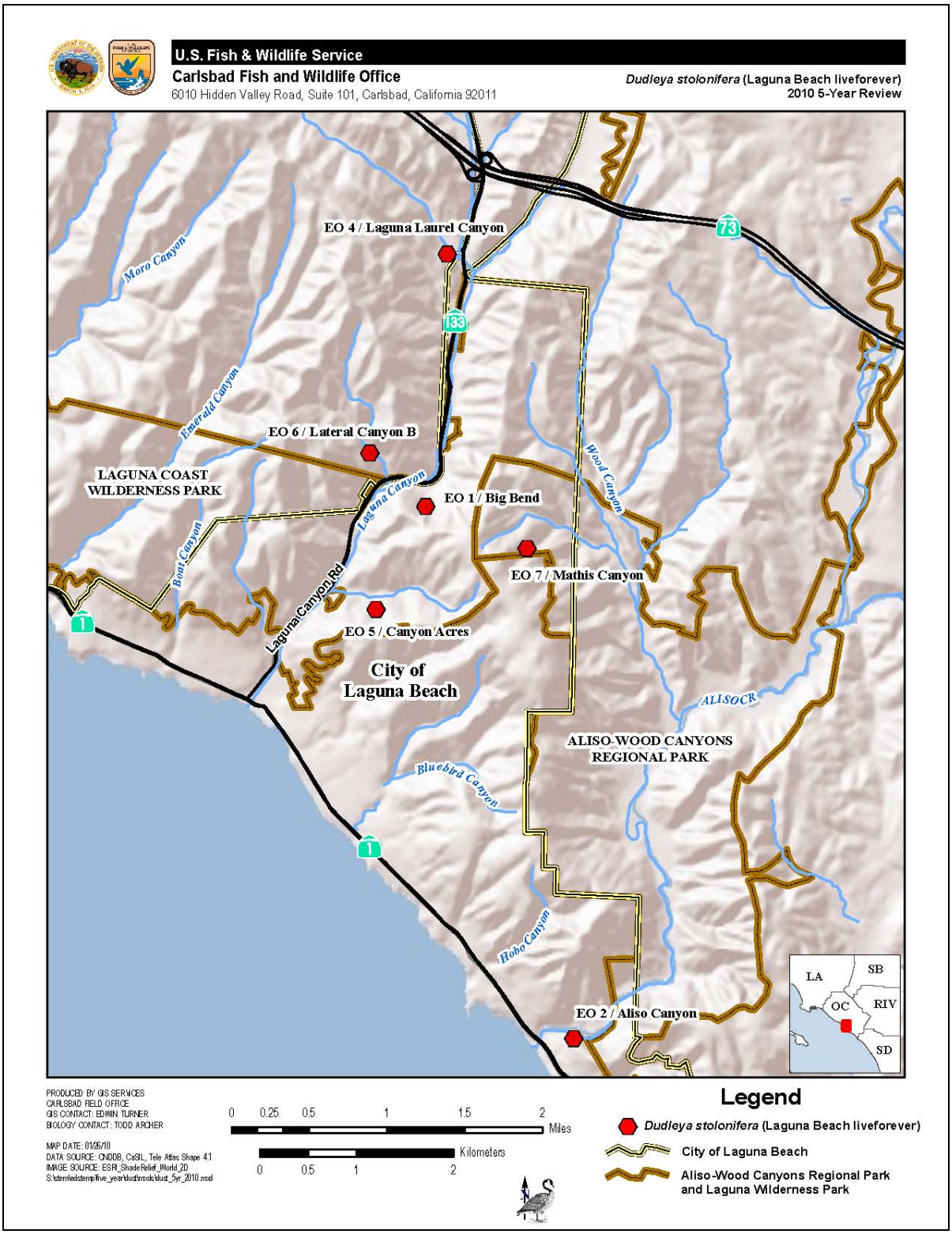

Figure 2. Distribution of *Dudleya stolonifera* (Laguna Beach liveforever) occurrences.

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Habitat or Ecosystem

Distribution of *Dudleya stolonifera* is restricted to shaded north-facing Miocene sandstone and San Onofre breccia rock outcrops, slopes, and canyon walls primarily in coastal sage scrub ecotypes (Moran, 1977, p. 1; Roberts 1997, p. 1). The taxon is also found in chaparral, cismontane woodlands, and valley and foothill grasslands at elevations up to 300 meters (1000 feet) (CDFG 1987, p. 1). Suitable habitats are restricted to discontinuous areas within the range of *D. stolonifera* (Moran 1977, p. 1) (CITES 2007, p. 1).

Figure 3. *Dudleya stolonifera* (Laguna Beach liveforever) habitat in Aliso Canyon. Photo credit Todd Archer (USFWS).

Dudleya stolonifera almost always co-occurs with mosses and lichens in a very thin layer of soil, often less than 1 cm (0.4 in) deep (Moran 1977, p. 1). It is commonly the only vascular plant in this habitat. In some locations it is accompanied by *Polypodium californicum* (California polypody) (Moran, 1977, p. 1) and in less steep situations by other plants such as *Jepsonia parryi* (coast jepsonia) (USFWS 1998, p. 54947), *Rhus integrifolia* (lemonade berry) (Roberts 1997, p. 1), and *Ericameria pinifolia* (pinebush) (Marsh et al. 1983, p. 100). Co-occurring *Dudleya* species include *D. edulis* (fingertips), *D. lanceolata* (lanceleaf liveforever), *D. pulverulenta* (chalk dudleya), *and D. multicaulis* (many-stemmed dudleya) (Bowler and Brown 1985, p. 4; TNC 1985, p. 2).

Dudleya stolonifera may have a positive association with a co-occurring lichen species, *Niebla ceruchoides* (angel-hair sea fog lichen) (Riefner and Bowler 1995, p. 81). *Niebla ceruchoides* is a saxicolous (lives among rocks) lichen also found in abundance in fog zones near the Pacific coast in Orange County (Riefner and Bowler 1995, p. 82). This fruticose (shrubby) lichen may benefit *D. stolonifera* by capturing seeds. The body of the lichen also provides the seed adequate moisture and a nutrient-rich soil bed. *Niebla ceruchoides* is consistently present with the Aliso Canyon occurrence (EO2) (Riefner and Bowler 1995, p. 82).

Changes in Taxonomic Classification or Nomenclature

There have been no changes in the nomenclature or taxonomic classification of *Dudleya stolonifera* since it was listed.

Genetics

Two hybrids of *Dudleya stolonifera* occur in Aliso Canyon (Thomson 1993, pp. 208, 210). This canyon is the only location where *D. stolonifera* and *D. edulis* co-occur, resulting in reported hybrids and apparent backcrosses that appear morphologically similar to one of the parent types. Results from genetic analysis reveal no irregularity of meiosis in *D. stolonifera* x *D. edulis* hybrids (Moran 1949, p. 112). Aliso Canyon also supports *D. lanceolata* x *D. stolonifera* hybrids, which represent the former presumed parent in the leaf rosette shape and the latter in

shorter, thicker leaves with maroon undersides (Thomson 1993, p. 210). This hybrid is less frequently encountered and no genetic analysis of individual has been performed.

Species-specific Research and/or Grant-supported Activities

We are aware of no current research or grant-supported activities related to *Dudleya stolonifera*.

Five-Factor Analysis

The following five-factor analysis describes and evaluates the threats attributable to one or more of the five listing factors outlined in section 4(a)(1) of the Act.

The final listing rule (USFWS 1998, pp. 54938–54956) identified the following threats to *Dudleya stolonifera*: rangewide loss of habitat from urbanization and edge effects, harvesting and overcollection in Aliso Canyon (EO 2), rangewide risks from small population sizes, increased shading and nonnative plant competition in Aliso Canyon (EO 2), fuels modification in Aliso Canyon (EO 2), grazing in Laguna Laurel Canyon (EO 4), and trampling in Laguna Laurel Canyon (EO 4) (USFWS 1998, p. 54946). The following five-factor analysis describes and evaluates the current threats to *D. stolonifera* relative to the five listing factors outlined in section 4(a)(1) of the Act.

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

At listing, urban development and associated edge effects were identified as threats impacting habitat occupied by *Dudleya stolonifera* (USFWS 1998, p. 54946). Prior to listing, the western portion of the Aliso Canyon occurrence (EO 2) was lost directly to development (USFWS 1998, p. 54939) and a portion of the Canyon Acres occurrence (EO 5) was cleared by a landowner (CNDDB 2010a). Development continues to be a threat to *D. stolonifera* occurrences and impacts to the habitat are discussed below.

Urbanization

Since listing, none of the known occurrences has been directly impacted by development related activities. The steep and rugged nature of *Dudleya stolonifera* habitat makes the remaining occurrences on private property undesirable for development. Nevertheless, adverse development effects are a potential threat to the two occurrences on private lands, Aliso Canyon and Canyon Acres (EO 2, 5), as pressure to develop private lands is not curbed by regulatory measures in the densely urbanized coastal portion of Orange County.

Dudleya stolonifera is a covered species under the Orange County Central-Coastal Natural Community Conservation Plan (NCCP)/Habitat Conservation Plan (HCP). The entire range of *D. stolonifera* lies within the Orange County Central-Coastal NCCP/HCP boundary, but all occurrences are not located on properties with participating landowners. Orange County manages state and local government lands that provide legal and physical protections for three

occurrences that are unlikely to be impacted by development: Laguna Laurel Canyon (EO 4), Lateral Canyon B (EO 6), and Mathis Canyon (EO 7). The occurrence at Big Bend (EO 1) is on City of Laguna Beach property and the remaining two occurrences, Aliso Canyon (EO 2) and Canyon Acres (EO 5), are on private land with no legal protections.

Proposed Development

Aliso Canyon (EO 2) is the occurrence most adversely affected by past development activities. The portion of this occurrence that was lost prior to listing is commercially developed. The remaining portion of this occurrence is threatened by expanded development as a result of the Aliso Canyon Redevelopment Plan (S. Drapkin, Senior Planner, City of Laguna Beach, pers. comm. 2010). This plan couldresult in the rebuilding of the Aliso Canyon Inn, but is delayed indefinitely as of 2008 (Drapkin, pers. comm. 2010).

Summary of Factor A

Currently, three of the six occurrences of *Dudleya stolonifera* are preserved on state and county park lands and fall under the protections of the Orange County Central-Coastal NCCP/HCP. The remaining three occurrences are not conserved and are located on private and City of Laguna Beach lands. The same habitat features that make *D. stolonifera* locally isolated (e.g. rock outcrops, canyon walls) also make the species' habitat inaccessible and less suitable for development. Nevertheless, the absence of any legal protection or partnerships at the unprotected sites makes future urban development activities a potential threat to *D. stolonifera* occurrences on private lands and City of Laguna Beach property.

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

It was noted in the 1998 listing rule that the limited number of *Dudleya stolonifera* plants made the species vulnerable to overcollection (USFWS 1998, p. 54947). At listing, *D. stolonifera* was known to be harvested for private collections (CITES 1982, p. 2). Field-collected specimens were also cultivated in area nurseries (USFWS 1998, p. 54947). The primary area of collection was Aliso Canyon (EO2) due to the proximity to the Pacific Coast Highway and ease of access.

Collection of *Dudleya stolonifera* is no longer believed to be a threat. Private harvesting of the species has not been documented since the listing of this species (K. Nakai, botanist, Hawthorne Nursery, Hawthorne, California, pers. comm. 2009). Additionally, the easily accessible portions of Aliso Canyon, where collections had occurred prior to listing, no longer exist; this area was developed and denuded of the taxon prior to listing (USFWS 1998, p. 54939).

FACTOR C: Disease or Predation

Grazing was identified as a threat to *Dudleya stolonifera* in the listing rule (USFWS 1998, p. 54947). Grazing occurred in the vicinity of the Laguna Laurel Canyon occurrence (EO 4)

through the mid 1990s. After grazing ceased, the *D. stolonifera* occurrence at this location appeared to significantly increase in size (Roberts 1997, p. 1). Grazing has been eliminated within these areas and is not considered a threat at this time.

Disease was not mentioned as a Factor C threat to *Dudleya stolonifera* in the listing rule (USFWS 1998, p. 54947). No plant diseases are known to affect *D. stolonifera*, thus disease does not pose a threat at this time.

FACTOR D: Inadequacy of Existing Regulatory Mechanisms

At listing, regulatory mechanisms that provided some protection for *Dudleya stolonifera* included: (1) the Act in cases where *D. stolonifera* co-occurred with a listed species; (2) CESA (the species was listed as threatened in California in 1987); (3) the California Environmental Quality Act (CEQA); (4) implementation of conservation plans pursuant to the Natural Community Conservation Planning Act; (5) land acquisition and management by Federal, State, or local agencies or by private groups and organizations (Aliso and Wood Canyons Wilderness Park); and (6) local laws and regulations. The listing rule analyzed the potential level of protection provided by these regulatory mechanisms (USFWS 1998, pp. 54947–54950).

The status of regulatory mechanisms with an impact on *Dudleya stolonifera* remains largely unchanged since listing. Several state and Federal mechanisms provide a conservation benefit to *D. stolonifera,* as follows:

State Protections in California

The State's authority to conserve rare wildlife and plants is comprised of four major statutes: CESA, the Native Plant Protection Act (NPPA), CEQA, and the Natural Community Conservation Planning Act.

Native Plant Protection Act (NPPA) and California Endangered Species Act (CESA):

Under provisions of NPPA (Division 2, chapter 10 section 1900 *et seq*. of the California Fish and Game Code (CFG)) and CESA (Division 3, chapter 1.5, section 2050 *et seq*. of CFG), the CDFG Commission listed *Dudleya stolonifera* as threatened in 1987. Both NPPA and CESA include prohibitions forbidding the "take" of *Dudleya stolonifera* (Chapter 10, Section 1908 and Chapter 1.5, Section 2080, CFG code). However, sections 2081(b) and (c) of CESA allow the CDFG to issue incidental take permits for state-listed threatened and endangered species if:

1) The authorized take is incidental to an otherwise lawful activity;
2) the impacts of the authorized take are minimized and fully mitigated;
3) the measures required to minimize and fully mitigate the impacts of the authorized take are roughly proportional in extent to the impact of the taking on the species, maintain the applicant's objectives to the greatest extent possible, and are capable of successful implementation;

4) adequate funding is provided to implement the required minimization and mitigation measures and to monitor compliance with and the effectiveness of the measures; and
5) issuance of the permit will not jeopardize the continued existence of a State-listed species.

Furthermore, with regard to prohibitions of unauthorized take under NPPA, landowners are exempt from this prohibition for plants to be taken in the process of habitat modification. Where landowners have been notified by the State that a rare or endangered plant is growing on their land, the landowners are required to notify CDFG 10 days in advance of changing land use in order to allow salvage of listed plants. The potential for salvaging and the success of transplanting *Dudleya stolonifera* plants are high when season and soil type are considered in the salvage plan (Thomson 1993, p. 3031).

California Environmental Quality Act (CEQA):

CEQA is the principal statute mandating environmental assessment of projects in California. The purpose of CEQA is to evaluate whether a proposed project may have an adverse affect on the environment and, if so, to determine whether that effect can be reduced or eliminated by pursuing an alternative course of action or through mitigation. CEQA applies to projects proposed to be undertaken or requiring approval by State and local public agencies (*http://www.ceres.ca.gov/topic/env_law/ceqa/summary.html*). CEQA requires disclosure of potential environmental impacts and a determination of "significant" if a project has the potential to reduce the number or restrict the range of a rare or endangered plant or animal; however, projects may move forward if there is a statement of overriding consideration. If significant effects are identified, the lead agency has the option of requiring mitigation through changes in the project or to decide that overriding considerations make mitigation infeasible (CEQA section 21002). Protection of listed species through CEQA is, therefore, dependent upon the discretion of the lead agency involved.

Natural Community Conservation Plans (NCCP):

In 1991, the State of California passed the Natural Community Conservation Planning Act to address the conservation needs of natural ecosystems throughout the State (CFG 28002835). The NCCP program is a cooperative effort involving the State of California and numerous private and public partners to protect regional habitats and species. The primary objective of NCCPs is to conserve natural communities at the ecosystem scale while accommodating compatible land uses. NCCPs help identify, and provide for, the regional or area-wide protection of plants, animals, and their habitats while allowing compatible and appropriate economic activity. Many NCCPs are developed in conjunction with HCPs prepared pursuant to the Act. On July 17, 1996, NCCP Approval and Take Authorization were issued by CDFG for the Orange County NCCP. *Dudleya stolonifera* is a "Covered Species" under the Orange County NCCP. Regional NCCPs may provide protection to federally listed species, such as *D. stolonifera*, by conserving native habitats upon which the species depend. The NCCP plan most significant to *D. stolonifera* is the Orange County Central/Coastal NCCP. The specific measures under the Orange County NCCP that afford protection to *D. stolonifera* are discussed below under the Act.

Federal Protections

Endangered Species Act of 1973, as amended (Act):

Since listing, the Act is the primary Federal law that may provide protection for this species. The Service's responsibilities include administering the Act, including sections 7, 9, and 10. Section 7(a)(2) of the Act requires Federal agencies, including the Service to ensure that actions they fund, authorize, or carry out do not "jeopardize" a listed species or result in the "destruction or adverse modification" of habitat in areas designated by the Service to be "critical." Critical habitat has not been proposed for this taxon. A jeopardy determination is made for a project that is reasonably expected, either directly or indirectly, to appreciably reduce the likelihood of both the survival and recovery of a listed species in the wild by reducing its reproduction, numbers, or distribution (50 C.F.R. § 402.02). A non-jeopardy opinion may include reasonable and prudent measures that minimize the amount or extent of incidental take of listed species associated with a project.

Under section 9(a)(2) of the Act, with respect to endangered plant taxa, it is unlawful to remove and reduce to possession (i.e., collect) any such taxon from areas under Federal jurisdiction; maliciously damage or destroy any such taxon on any such area; or remove, cut, dig up, or damage or destroy and such species on any other area in knowing violation of any law or regulation of any State or in the course of any violation of a State criminal trespass law. As noted above *Dudleya stolonifera* is listed as endangered by the State of California. Therefore this species is afforded protections under section 9 of the Act on non-Federal lands.

Under Section 10(a)(1)(A) of the Act there are provisions for collection of plants or plant parts for scientific purposes or to enhance the propagation and survival of the species. Under section 10(a)(1)(B) the Service may issue "incidental take" (take is defined in section 3(18) of the Act) permits for listed animal species to non-Federal applicants. Take and therefore incidental take protections are not extended to plants. "Incidental take" refers to taking of listed species that results from, but is not the purpose of, carrying out an otherwise lawful activity by a Federal agency or applicant (50 CFR 402.02). To qualify for an incidental take permit, applicants must develop, fund, and implement a Service-approved HCP that details measures to [avoid] minimize and mitigate the project's adverse impacts to listed species including listed plants. Issuance of an incidental take permit by the Service is subject to section 7 of the Act; thus, the Service is required to ensure that the actions proposed in an HCP are not likely to jeopardize the animal or plant species or result in the destruction or adverse modification of critical habitat. Therefore, HCPs may provide an additional layer of regulatory protection to animals as well as plants. Although Section 10(a)(1)(B) of the Act allows for exemptions to take prohibitions under section 9 for animals, it does not allow for similar exemptions for plants. Many NCCPs are developed in conjunction with HCPs prepared pursuant to the Act. The Orange County Central-Coastal NCCP/HCP is discussed below.

Orange County Central-Coastal NCCP/HCP:

The Orange County Central-Coastal NCCP/HCP covers about 84,178 hectares (ha) (208,000 acres (ac)) in eight local jurisdictions (Cities of Anaheim, Costa Mesa, Irvine, Laguna Beach, Newport Beach, Orange, San Juan Capistrano, plus unincorporated areas of Orange County) (Orange County 1996, p. I-17). *Dudleya stolonifera* is identified as a covered species in this NCCP/HCP because it is endemic to the subregion and three of the six occurrences occur within the Orange County Central-Coastal NCCP/HCP Reserve System. The Orange County Central-Coastal NCCP/HCPs adaptive management program addresses adverse edge effects to *D. stolonifera* through its biological monitoring and habitat enhancement activities, which include invasive species control efforts (Orange County 1996, p. II163). The entire range of *D. stolonifera* lies within the boundaries of the Orange County Central-Coastal NCCP/HCP but only three occurrences lie on the properties of participating landowners. Occurrences at Laguna Laurel Canyon (EO 4), Lateral Canyon B (EO 6), and Mathis Canyon (EO 7) receive direct benefits from the Orange County Central-Coastal NCCP/HCP through adaptive management (Orange County 1996, p. II246).

Aliso and Wood Canyons Wilderness Park - Resource Management Plan:

Aliso and Wood Canyons Wilderness Park (AWCWP) cover 1,567 ha (3,873 ac) of hills, canyons, and floodplains (Orange County 2009, p. 1). It is owned and operated by Orange County Parks. The Resource Management Plan (RMP) is the required program for implementing Orange County Central-Coastal NCCP/HCP policies and adaptive management plans for fire, recreation, and restoration/enhancement within the NCCP/HCP habitat reserve system (Orange County 2009, p. 2). The objective of the RMP is to identify the best ways to manage, protect, and enhance the natural resource values of AWCWP while balancing the needs of the local community for safe recreational and educational opportunities (Orange County 2009, p. 2).

The RMP identifies rock and cliff habitats as the primary habitat for *Dudleya stolonifera* and specifies annual monitoring of the species. The RMP also provides for eradication of invasive weeds. Fuel modification areas in the fire management plan guard against aggressive vegetation removal and conversion to nonnative plants. Mathis Canyon (EO 7) lies within the AWCWP boundaries and benefits from this oversight in the RMP.

National Environmental Policy Act (NEPA):

NEPA (42 U.S.C. 4371 *et seq*.) provides some protection for listed species that may be affected by activities undertaken, authorized, or funded by Federal agencies. Prior to implementation of such projects with a Federal nexus, NEPA requires the agency to analyze the project for potential impacts to the human environment, including natural resources. In cases where that analysis reveals significant environmental effects, the Federal agency must propose mitigation alternatives that would offset those effects (40 C.F.R. 1502.16). These mitigations usually provide some protection for listed species. However, NEPA does not require that adverse impacts be fully mitigated, only that impacts be assessed and the analysis disclosed to the public.

Summary of Factor D

The Act is the primary law providing protection for *Dudleya stolonifera* since its listing as a federally threatened species in 1998. The provisions included in the Orange County Central-Coastal NCCP/HCP provide for protection of three of six *D. stolonifera* occurrences and adaptive management of the habitat of those three occurrences in order to help address threats to the plant from development and nonnative plants.

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

The 1998 listing rule identified the following threats to *Dudleya stolonifera* under Factor E: stochastic (unexpected) risks to small populations, increased competition from nonnative plant species, fuels modification associated with fire damage, and trampling (USFWS 1998, p. 54950). The threat of trampling associated with grazing (see Factor C) that is mentioned in the listing rule is believed to be in error. No evidence of this threat was identified in the listing rule and trampling does not appear to be a threat today. Since listing, a new threat to *D. stolonifera* plants is climate change. An assessment of the Factor E threats currently facing *D. stolonifera* is provided below.

Small Population Size

The listing rule discussed the vulnerabilities associated with few occurrences of small population sizes for *Dudleya stolonifera*. These vulnerabilities included susceptibility to stochastic events such as flood, fire, or drought and inbreeding depression (USFWS 1998, p. 54950).

Small population size may be the result of several conditions, including local extirpations or ongoing natural or artificial factors limiting establishment and survival of the taxon.

Stochastic, or unexpected, events represent a significant threat to small occurrences. In the case of *Dudleya stolonifera*, two of the six occurrences (Canyon Acres (EO 5) and Lateral Canyon B (EO 6)) can be considered small, each represented by less than 100 standing plants. Stochastic events that could destroy these smaller occurrences include flood, fire, or drought. Given the impact these events could have on a third of the known populations of *D. stolonifera*, they represent a potential threat to the species as a whole.

There is also a potential for small populations to suffer from inbreeding depression. Inbreeding depression is the reduced fitness resulting from breeding of related individuals, most often in small populations, by highlighting deleterious genetic traits. In order to avoid inbreeding depression it is important to maintain genetic diversity, especially for rare alleles (different forms of a gene). The likelihood of maintaining this diversity decreases in smaller populations (Barrett and Kohn 1991, pp. 9, 10, and 13). In the event *Dudleya stolonifera* is a self-incompatible (outcrossing) plant, maintaining diversity of alleles to ensure production of fertile seeds is important for the survival of plant populations). Though this potential threat is not immediate, it does increase concern for small, isolated populations of *Dudleya stolonifera.*

In 2009, a RMP for AWCWP was completed. It included a variety of actions to protect and restore the natural resources in AWCWP, including fire management, nonnative plant removal, and annual surveys of the *Dudleya stolonifera* occurrences (Orange County 2009, p. 256). Though not directly managing the two smaller populations, the data from these annual surveys will make future abundance measures more meaningful and may help quantify potential occurrence stability, thereby countering threats associated with small populations.

Nonnative Plant Competition

At listing, nonnative plant competition was considered a threat to *Dudleya stolonifera*, though severity and specific occurrence information were not provided (USFWS 1998, p. 54950). Since listing, direct competition to *D. stolonifera* by nonnative plant species has remained a threat at two occurrences, Aliso Canyon (EO 2) and Mathis Canyon (EO 7). This threat is most prevalent in Aliso Canyon (EO 2) where *Tropaeolum majus* (nasturtium), *Aeonium haworthii* (pinwheel) (Roberts, pers. comm. 2009b), *Myoporum laetum* (myoporum) (Roberts 1995, p. 2), *Echium* spp., and *Echeveria* spp. (Marsh 1992, p. 65) have been found within habitat occupied by *D. stolonifera*. These nonnative species thrive among rocks and compete directly with *D. stolonifera* for limited resources (e.g., soil moisture, space, light). In particular, *A. haworthii* is accelerating its competition with *D. stolonifera* and is displacing the taxon from the western end of the Aliso Canyon occurrence (EO 2) (Roberts, pers. comm. 2009b).

The RMP for AWCWP includes measures to help address nonnative plant removal for the Mathis Canyon occurrence (EO 7) (Orange county 2009, p. 75). Encroachment and competition from nonnative plants into this area will likely be reduced as this management plan is implemented.

Fuels Modification

Threats associated with fuels modification (thinning vegetation, fire breaks, disking, and mowing) for fire prevention and damage reduction were mentioned but not discussed at listing. Fires burned four of the six *Dudleya stolonifera* occurrences in the last 30 years (CDFFP 2003). Though no direct effects to *D. stolonifera* due to fuels modification practices have been documented since listing, the potential hazard of wildfire has prompted the clearing of edge vegetation surrounding the Top of the World subdivision near the Mathis Canyon occurrence (EO 7) (Roberts, pers. comm. 2009b). Proactive measures should be taken to avoid adverse effects while fighting active fires and to ensure that fuels modification activities avoid the taxon to the maximum extent practicable. The Orange County Central-Coastal NCCP/HCP prescribes criteria for fuels modification to limit the encroachment of invasive species and precludes them within reserve boundaries (Orange County 2006, p. II338). However, the plan allows fuels modification to occur in proximity to some of the known occurrences of *D. stolonifera*. Fuels modification related activities remain a potential threat to the Mathis Canyon (EO 7) and Big Bend (EO 1) occurrences of *D. stolonifera*, which are near the Top of the World subdivision.

Climate Change

Since listing, it has become apparent that potential threats exist to biota of the United States from ongoing, accelerated climate change (IPCC 2007). Current climate change predictions for terrestrial areas in the Northern Hemisphere indicate warmer air temperatures, more intense precipitation events, and increased summer continental drying are predicted for the foreseeable future (Field et al. 1999; Cayan et al. 2005; IPCC 2007).

Climate modeling for California indicates similar outcomes in temperature and precipitation. Recent assessments have been carried out running low and medium emission scenarios through the six models used in the 2007 International Panel on Climate Change assessment. The results predict a 1 to 3 degrees Celsius (1.8 to 5.4 degrees Fahrenheit) increase in average temperature by the year 2050 (Cayan et al. 2009, p. 16). Over the same period, a 12 to 35 percent decrease in precipitation is indicated (Cayan et al. 2009, p. 17).

Significant temperature increases create a stressor for endemic species. This stressor enhances pressures from competitors, nonnative species, habitat change, low water supply, and disease. Species must somehow adapt to these pressures *in situ* (in place) or shift their geographic range (Cayan et al 2009, p. 45). Such a shift in range for narrow endemic species such as *Dudleya stolonifera* could exceed the tolerance of the species. Additionally, there is very little available habitat in coastal Orange County to assist this species with a range shift. Though we know little of the adaptive ability of *D. stolonifera,* climate change could potentially pose a significant rangewide threat to the species.

Summary of Factor E

With the exception of climate change, Factor E threats to *Dudleya stolonifera* have changed little since listing. Threats associated with small population size affect this species rangewide. The primary threat to the Aliso Canyon occurrence (EO 2) is likely nonnative plant competition, though this threat is not prevalent rangewide. Fuels modification activities potentially threaten the largest occurrence of the species, though the threat exists anywhere the species occurs near developed areas. Though difficult to quantify, change in climate may impact all occurrences of *D. stolonifera* and poses a significant threat to this species in the future.

III. RECOVERY CRITERIA

No recovery plan or outline has been prepared for *Dudleya stolonifera*.

IV. SYNTHESIS

At listing, *Dudleya stolonifera* was threatened by habitat loss from urbanization and edge effects, harvesting and overcollection, risks associated with small populations, nonnative plant competition, fuels modification, grazing, and trampling. The status of *D. stolonifera* has not changed significantly since its listing. Its range has not diminished and all six historical occurrences are considered extant. Two of the six occurrences are on private property with no legal protections and one occurrence was recently subject to a development plan that was withdrawn. Although this project was voluntarily withdrawn, it could be resubmitted for development at a future date. Countering this threat are the legal and physical protections of the remaining three occurrences by the adaptive management of the Orange County Central/Coastal NCCP/HCP. The small population sizes of two occurrences make them susceptible to limited gene flow among occurrences, increasing the vulnerability of small populations to a range of environmental and genetic stochastic factors. Nonnative plant competition is one of the more tangible threats for occurrences in Aliso Canyon (EO 2) and Mathis Canyon (EO 7), but is expected to be somewhat alleviated in areas of concern by the Resource Management Plan for Aliso and Wood Canyons Wilderness Park, because Orange County Parks will monitor the species and target nonnative competitors.

Despite persistent threats, protection efforts have provided some level of stability for *Dudleya stolonifera*, which could potentially become endangered within the foreseeable future throughout all or a significant portion of its range. Therefore, we find that *D. stolonifera* still meets the definition of threatened, and recommend no status change at this time.

V. RESULTS

Recommended Listing Action:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist (indicate reason for delisting according to 50 CFR 424.11):
    ____ *Extinction*
    ____ *Recovery*
    ____ *Original data for classification in error*
__X__ No Change

New Recovery Priority Number and Brief Rationale:

We recommend no change in the recovery priority number of 8 at this time. The taxon is a species that faces a moderate degree of threat and a high recovery potential.

VI. RECOMMENDATIONS FOR ACTIONS OVER THE NEXT 5 YEARS

1) Work with partners to help conserve *Dudleya stolonifera* occurrences on private property at Big Bend (EO 1), Aliso Canyon (EO 2), and Canyon Acres (EO 5). Identify opportunities through the Service's Partners Program to conduct potential research, conduct surveys, and develop monitoring protocols.

2) Identify opportunities for conservation or preservation for *Dudleya stolonifera* occurrences on private lands. Property easements or purchases of these parcels could be made through the Act's section 6 funding and other programs.

3) Develop plan to monitor and document the number of standing plants and threats at all occurrences in coordination with subsequent 5-year reviews. Mathis Canyon (EO 7) is currently the only occurrence with an established monitoring program.

4) Research *Dudleya stolonifera* reproductive strategies and pollinator requirements.

5) Determine if genetic distinctness exists across occurrences in the two watersheds that comprise the existing range.

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW

Dudleya stolonifera
(Laguna Beach liveforever)

Current Classification: Threatened

Recommendation Resulting from the 5-Year Review:

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

Review Conducted By: Carlsbad Fish and Wildlife Office

FIELD OFFICE APPROVAL:

Lead Field Supervisor, U.S. Fish and Wildlife Service

Approve _____ Date 4-16-10
Acting DFS

Appendix 1: Occurrences of *Dudleya stolonifera* (Laguna Beach liveforever); prepared for 5-year review, 2010.

Occurrence (Occurrence Alias)	**Element Occurrence**	**Voucher Source** (Herbarium Record)	**Year Documented**	**Count**	**Current Threat**	**Ownership**	**Protection**
Aliso Creek Watershed							
Aliso Canyon (Aliso Creek Inn and Golf Course) (ce147 CalFlora; Hole 3)	EO 2	Moran 3287 (UC905131, RSA 397833) Moran 3259 (UC 933268) Reed 4994 (POM48549) Moran 3095 (UC806717, UC905132, POM 301406, DS342181) Moran 24238 (SD 130042) Perkins (RSA423513) Howe 4363 (SD114480) Athens/PCR Services	1949 1949 1925 1925 1948 1977 1912 1967 2006 observation	1,000 in 1991 (CNDDB 2010a)	Factor A: Development; Factor E: nonnative competition	Private (CNDDB 2010a)	Unknown
Mathis Canyon (Upper Aliso Creek/Temple Hill East/ Bonn Drive)	EO 7	Unvouchered	1992	20,000 in 1992	Factor E: Fuel modifications; nonnative competition	City of Laguna Beach - parcel #82 (LB GIS 2009)	Managed by Orange County in Aliso and Wood Canyons Wilderness Park
Laguna Canyon Watershed							
Canyon Acres (Lower Laguna Canyon)	EO 5	Unvouchered	1982	<60 in 1982 (CNDDB 2010a)	Factor A: Development; Factor E: small populations; fuel modifications	Private (CNDDB 2010a). Directly adjacent lots to east are owned by City of Laguna Beach (parcels #140, #145)	Unknown
Lateral Canyon B (Lower Laguna Canyon)	EO 6	Unvouchered	1974	Small in 1972 (CNDDB 2010a)	Factor E: Small populations	Orange County	Managed by Orange County in Laguna Coast Wilderness Park
Big Bend (Lower Laguna Canyon)	EO 1	Moran 3286 (UC905134); Moran 3411(UC 1015150) Roberts 1360 (IRVC25030)	1949 1950 1984	Large (CNDDB 2010a)	Factor E: Fuel modifications	City of Laguna Beach (parcel #157)	Unknown
Laguna Laurel Canyon (Upper Laguna Canyon/Willow Canyon/Irvine Ranch) (ce197 CalFlora) (67515, 312992 CalFlora)	EO 4	Roberts 1815 (IRVC22787) Muns/Chester Moran 24230 (RSA534167, SD129960, UCR 67711, SBBG96432)	1985 2003 1977	800 in 1985, 2,561 in 1991 (CNDDB 2010a)	None	California Department of Fish and Game	Managed by Orange County in Laguna Coast Wilderness Park (CNDDB 1990)