

Santa Barbara Island Liveforever

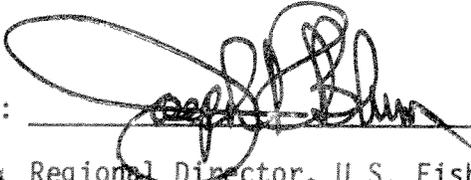


Recovery Plan



RECOVERY PLAN FOR THE
SANTA BARBARA ISLAND LIVEFOREVER

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THIS IS THE COMPLETED SANTA BARBARA ISLAND LIVEFOREVER RECOVERY PLAN. IT HAS BEEN APPROVED BY THE U.S. FISH AND WILDLIFE SERVICE. IT DOES NOT NECESSARILY REPRESENT OFFICIAL POSITIONS OR APPROVALS OF COOPERATING AGENCIES OR INDIVIDUALS WHO PLAYED KEY ROLES IN PREPARING THIS PLAN. IT HAS BEEN PREPARED BY MEMBERS OF THE CHANNEL ISLANDS NATIONAL PARK PLANNING TEAM UNDER AN INTERAGENCY AGREEMENT WITH THE U.S. FISH AND WILDLIFE SERVICE AND BY JIM A. BARTEL OF THE SACRAMENTO ENDANGERED SPECIES OFFICE, U.S. FISH AND WILDLIFE SERVICE, TO DELINEATE REASONABLE ACTIONS WHICH ARE BELIEVED TO BE REQUIRED TO PLACE THE ASSIGNED SPECIES IN THE BEST POSSIBLE POSITION. THIS PLAN IS SUBJECT TO MODIFICATION AS DICTATED BY NEW FINDINGS AND CHANGES IN SPECIES' STATUS AND COMPLETION OF TASKS DESCRIBED IN THE PLAN. GOALS AND OBJECTIVES WILL BE ATTAINED AND FUNDS EXPENDED CONTINGENT UPON APPROPRIATIONS, PRIORITIES, AND OTHER BUDGETARY CONSTRAINTS.

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TABLE OF CONTENTS

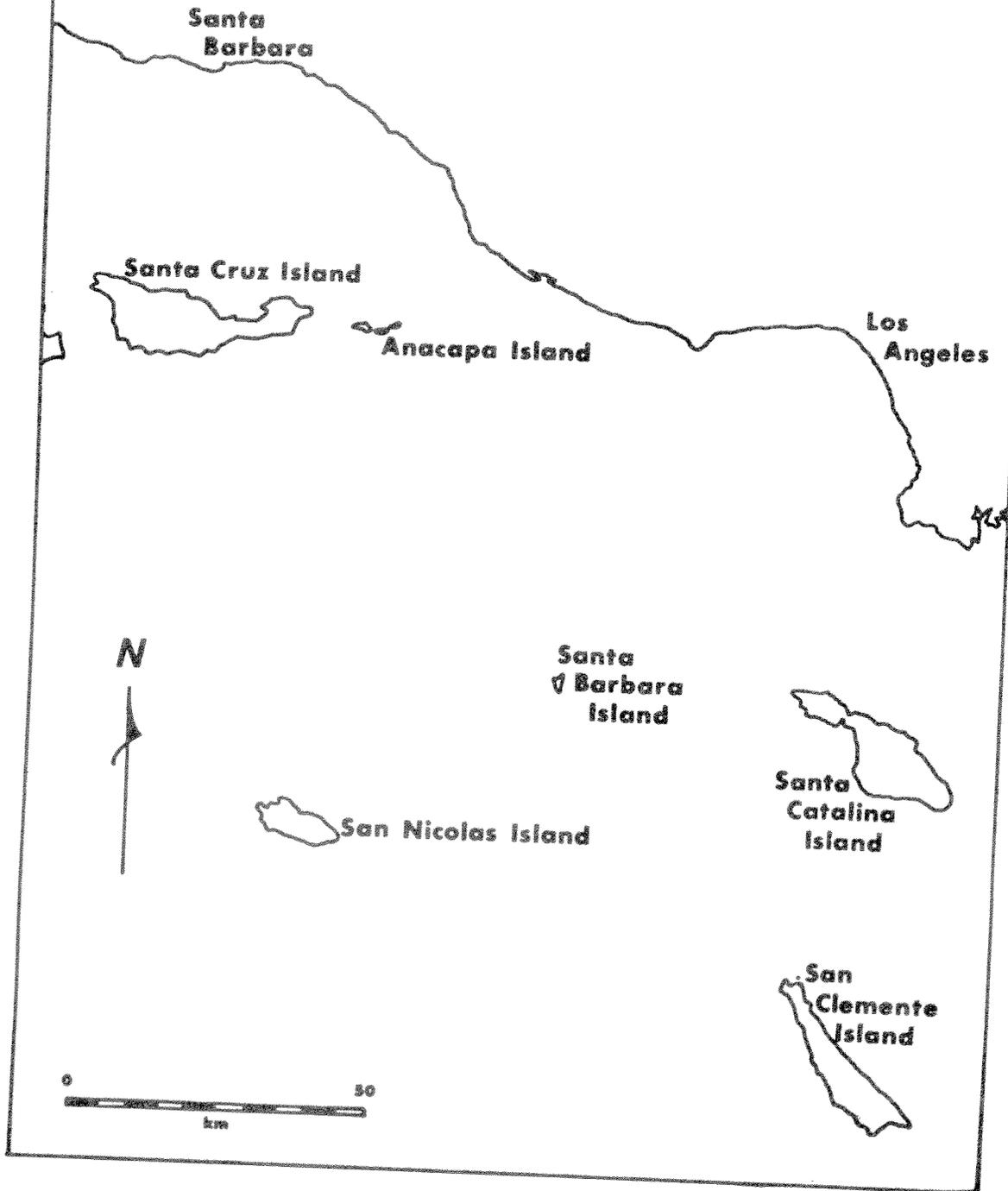
	<u>Page</u>
PART I. INTRODUCTION	1
Taxonomy	3
Description.	5
Distribution and Habitat	6
Historic Impacts and Current Threats	12
Past and Current Conservation Efforts	19
PART II. RECOVERY	22
Objective	22
Step-Down Outline	24
Narrative	26
Literature Cited	36
PART III. IMPLEMENTATION SCHEDULE	41
APPENDIX	
Vascular Plants of Santa Barbara Island.	46
Agencies Requested to Provide Comments during Agency Review	52



PART I INTRODUCTION

Dudleya traskiae (Rose) Moran, the Santa Barbara Island liveforever, is primarily restricted to the steep cliffs of Santa Barbara Island, one of the smallest of the Channel Islands located off the southern California coast and part of the Channel Islands National Park under the management of the National Park Service (Figure 1). The liveforever, which had not been collected since 1968, was presumed extinct in the wild when attempts to relocate the plant failed in 1970 (Philbrick 1972). Grazing and trampling by feral animals have been cited as the primary causes for the decline in the species. The decline evidently was so severe that it was not until 1975 that any liveforever plants were relocated. Today, a few scattered populations of probably fewer than 700 plants, including seedlings, dot the cliffs of the island, and the species remains in cultivation in several botanical gardens. The precarious state of these populations prompted the U.S. Fish and Wildlife Service to list D. traskiae as endangered under the Endangered Species Act (43 Federal Register 17916) on 26 April 1978. During the Fourth Meeting of the Conference of the Parties to the Convention of International Trade in Endangered Species (CITES) (19-30 April 1983), the species was added to Appendix I to restrict foreign commerce.

FIGURE 1
Location of Santa
Barbara Island



Taxonomy

Dudleya traskiae is a member of the Crassulaceae or orpine family. This family, aside from its floral features, is characterized by its fleshy or succulent foliage (Lawrence 1951), a quality making the Crassulaceae a favorite among fanciers of novel and unique plants and a problem for the plant taxonomist. Because of the difficulty pressing succulent plants, morphological characters on herbarium specimens typically differ greatly from living material (Tolken 1977). Moreover, natural variation, aneuploidy, polyploidy, and hybridization, common characteristics of the family, make systematics difficult (Uhl 1963). Thus, genera and species within the Crassulaceae are not clearly delimited and the number of recognized taxa in the family varies significantly from authority to authority (Lawrence 1951). Uhl (1948) maintained that no two students of the Crassulaceae could agree on any aspect of taxonomy and as a result taxonomic disputes are not unusual. The nomenclatural history of many taxa in the family can be confusing and replete with complicated discussions of synonymy.

Surprisingly, however, the nomenclatural history of Dudleya traskiae is relatively simple and clear, although there has been some confusion regarding the appropriate generic epithet for the species. Nathaniel Britton, former Director-In-Chief of the New York Botanical Garden, and Joseph Rose, expert on the Crassulaceae and former Associate Curator of the U.S. National Herbarium, collaborated on two significant monographs detailing the Crassulaceae of North America in 1903 and 1905. In their 1903 paper, they described the genera

Dudleya, Hasseanthus, and Stylophyllum. Until this time, the dudleyas of California had been variously placed within Sedum, Echeveria, and Cotyledon (Britton and Rose, 1903 and 1905). Nonetheless, even after Britton and Rose treated the family in 1905 in the North American Flora series, several taxonomists did not agree with their treatment. For example, Willis Jepson (1936) believed the characters cited by Britton and Rose failed to consistently separate Dudleya from Echeveria.

Reid Moran, authority on the Crassulaceae and former Curator of the San Diego Museum of Natural History Herbarium, agreed with the basic limits of Dudleya, Hasseanthus, and Stylophyllum. He, however, among other things, reduced Stylophyllum to a subgenus of Dudleya in a series of articles in 1942 and 1943. The subgenus Dudleya differs from Stylophyllum by its erect and appressed follicles and nearly tubular flowers. Moran (1943) also noted that many of the species of the subgenus Stylophyllum are "characterized by remarkable endemism".

Dudleya traskiae was described by Rose in Britton and Rose in 1903. He named the liveforever Stylophyllum traskae in honor of Blanche Trask, a long-time resident of Santa Catalina Island and traveler of the Channel Islands, who discovered the species in May of 1901. Although Moran (1942) placed the species within Dudleya and the subgenus Stylophyllum, he (1942, 1943, 1951, and 1978) stated that the flowers of the Santa Barbara Island liveforever are intermediate between the subgenera Dudleya and Stylophyllum.

Moran (1951 and 1978) speculated that because Dudleya traskiae is a tetraploid, it may have originated as an amphidiploid between species of the subgenera Dudleya and Stylophyllum. Nonetheless, he maintained that the intermediacy of the floral characters, campanulate flowers, and the doubled chromosomes of the species make D. traskiae a very distinct species; a feature rare among dudleyas (Moran 1943 and 1978). He postulated that the dearth of herbarium specimens led Phillip Munz (1935) and Jepson (1936) to conclude in their floras that D. traskiae should be placed in synonymy (Moran 1943). Accordingly, Munz (1959 and 1974) in his later floras concurred that D. traskiae was a distinct species and Philbrick (1972) felt that it was "taxonomically the most distinctive endemic of Santa Barbara Island."

Description

The Santa Barbara Island liveforever, like other dudleyas, is a small perennial herb with pentamerous flowers; five petals and carpels or follicles, and ten stamens. The flowering stems arise from the axils of basal rosettes. Clusters of 20 to 100 rosettes per plant are typical with 25-35 leaves per rosette. The rosette leaves are 4-15 cm long, 1-4 cm wide, and 4 to 6 times broader than thick. The oblong to oblong-lanceolate leaves are acute to subacuminate at the tip and frequently concave above. Individuals of Dudleya traskiae typically exhibit glaucous gray or frequently non-glaucous green foliage. These foliar races are not unique among the various species of Dudleya (Philbrick 1980) and reportedly have adaptive significance (Mulroy 1976 and 1979).

Dudleya traskiae generally blooms from April to May, although it occasionally will flower as early as mid-February (Moran 1978) and as late as June (Gary Fellers, pers. comm., 3 July 1984)*. The erect floral stems stand 20-30 cm tall. Much reduced triangular-ovate cauline leaves attached to the floral stems increase in size towards the basal rosette. The narrowly-ovate petals are bright yellow, acute at the tip, and frequently tinged with red along the mid-vein (Moran 1951). The distinctive appearance of D. traskiae, the only liveforever on Santa Barbara Island, makes it unlike any other plant growing on the island.

Distribution and Habitat

Dudleya traskiae is known only from Santa Barbara Island, located some 61 km (38 miles) from the mainland (Philbrick 1967). The island, 264 hectares (652 acres) in size and bounded by rugged precipitous cliffs, lacks sandy beaches. A prominent topographic feature of the island, a low north-south oriented saddle, unites Signal Peak and North Peak. Signal Peak, the highest point on the island, reaches 193 m (635 feet) above sea level while North Peak rises 171 m (565 feet). Much of the island, however, consists of marine terraces that slope gently down to the edge of the cliffs to the east and west.

Geologically, the island consists predominantly of basalt and some light-colored marine sediments. Reportedly, it is the remnant north

* Gary Fellers, Research Biologist, Point Reyes National Seashore, Point Reyes, California.

slope of a Miocene volcano (Power 1979). Edaphically, the soil of the island is fertile on the terraces, whereas it is "thin and coarse" in areas of constant high winds and steep slopes, like that occupied by the liveforever (Philbrick 1972). D. acuminata, for example, was referred to as a saxicolous (occurring among rocks) species by Ryti (1984), a common characteristic of liveforevers. Commonly called "rock" or "cliff lettuce" (Jepson 1936), most dudleyas occupy sites with similiar shallow rocky soils. Perhaps liveforevers cannot compete with other plants on deeper soils. Perhaps the succulent habit and/or possession of CAM (crassulacean acid metabolism) photosynthesis (Teeri 1984) enables dudleyas to persist on these xeric sites with shallow soils apart from more aggressive plants growing on deeper soils.

No accurate account exists for the historical distribution of the Santa Barbara Island liveforever. Until recently, only general places on the island were cited as harboring Dudleya traskiae. The species probably occupied much more of the island than it does today. The distribution of the plant doubtlessly has been much altered by man either directly or indirectly. Some of the impacts to the plant and its habitat include but are not limited to grazing, cultivation, burning, and construction.

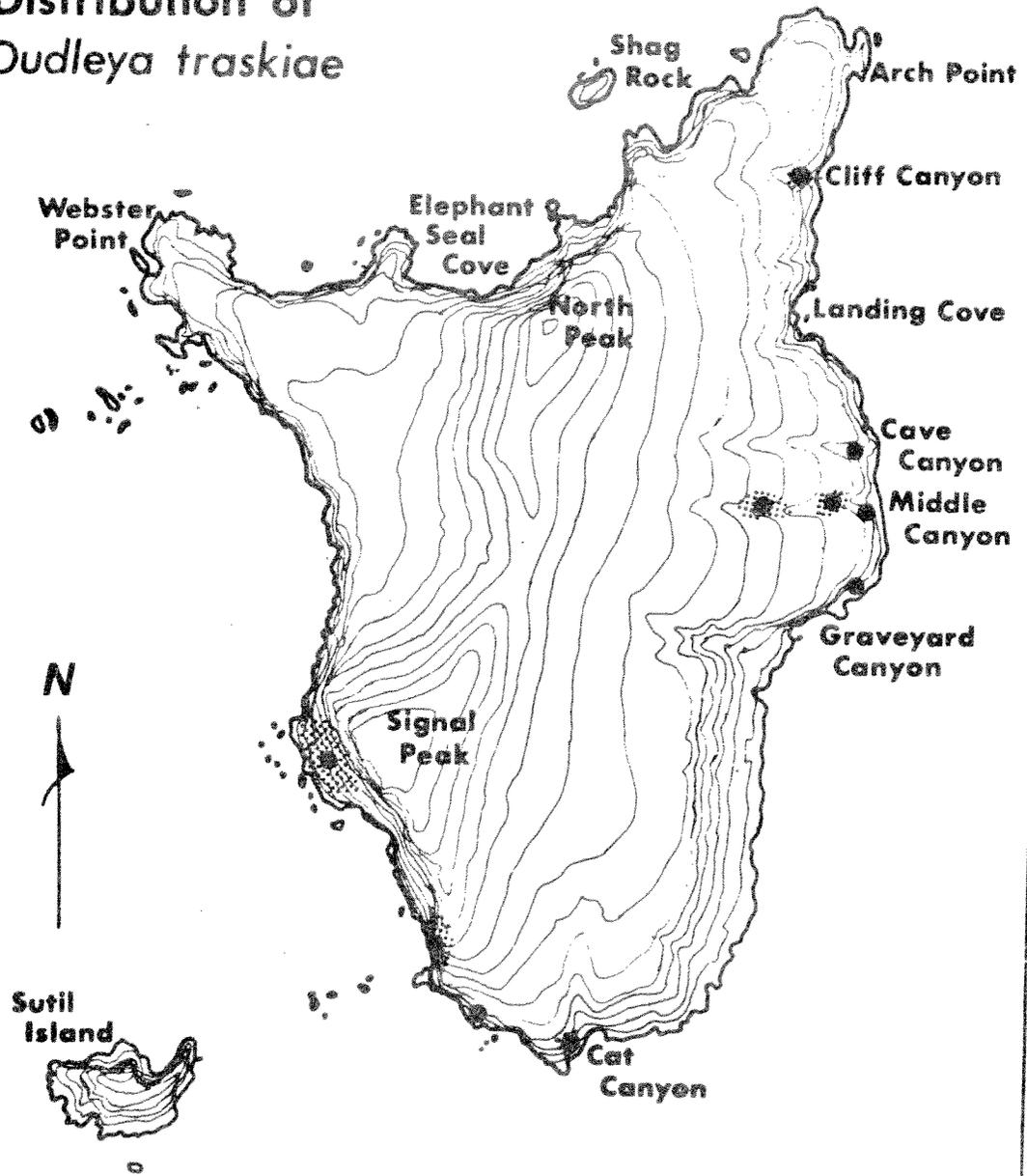
According to surveys conducted in 1982, 1983, and 1984 by National Park Service personnel (Charles Drost, research assistant; Charles Scott, island ranger; and Gary Fellers, research scientist), only ten

colonies or "populations" of the dudleya remain on the slopes of the island (Figure 2). The 1984 survey reported that 229 mature individuals persist mostly as large plants with numerous rosettes. For example, one individual in Cave Canyon consists of more than 20 rosettes and covers nearly a half meter square of steep and rocky terrain. Although several plants consist of solitary rosettes, there are no data to indicate the age of these smaller individuals. Most of the smaller dudleyas grow on the southwest slope of Signal Peak.

A few scattered liveforever plants remain on the south- to southeast-facing slopes of Cave and Middle Canyons, although three dudleyas grow on the north-facing slope of Middle Canyon. Including the solitary plant north of the mouth of Graveyard Canyon and the seven plants inhabiting the seaslope between Arch Point and Cliff Canyon, the east side of the island harbors nearly 21 percent of the known dudleyas. This figure includes the reported 49 plants within Cat Canyon. The Signal Peak colony, the largest stand, numbers at least 84 mature and 534 total plants. While 95 plants flowered in 1983, the National Park Service observed only 58 individuals blooming in 1984.

The National Park Service's systematic search for D. traskiae in 1982, 1983, and 1984 revealed the precarious state and rarity of this succulent. The work may also provide good baseline data for further monitoring and demographic studies. Nonetheless, a permanent marking technique might improve further this monitoring effort so that results from year to year are truly comparable.

FIGURE 2
Distribution of
Dudleya traskiae



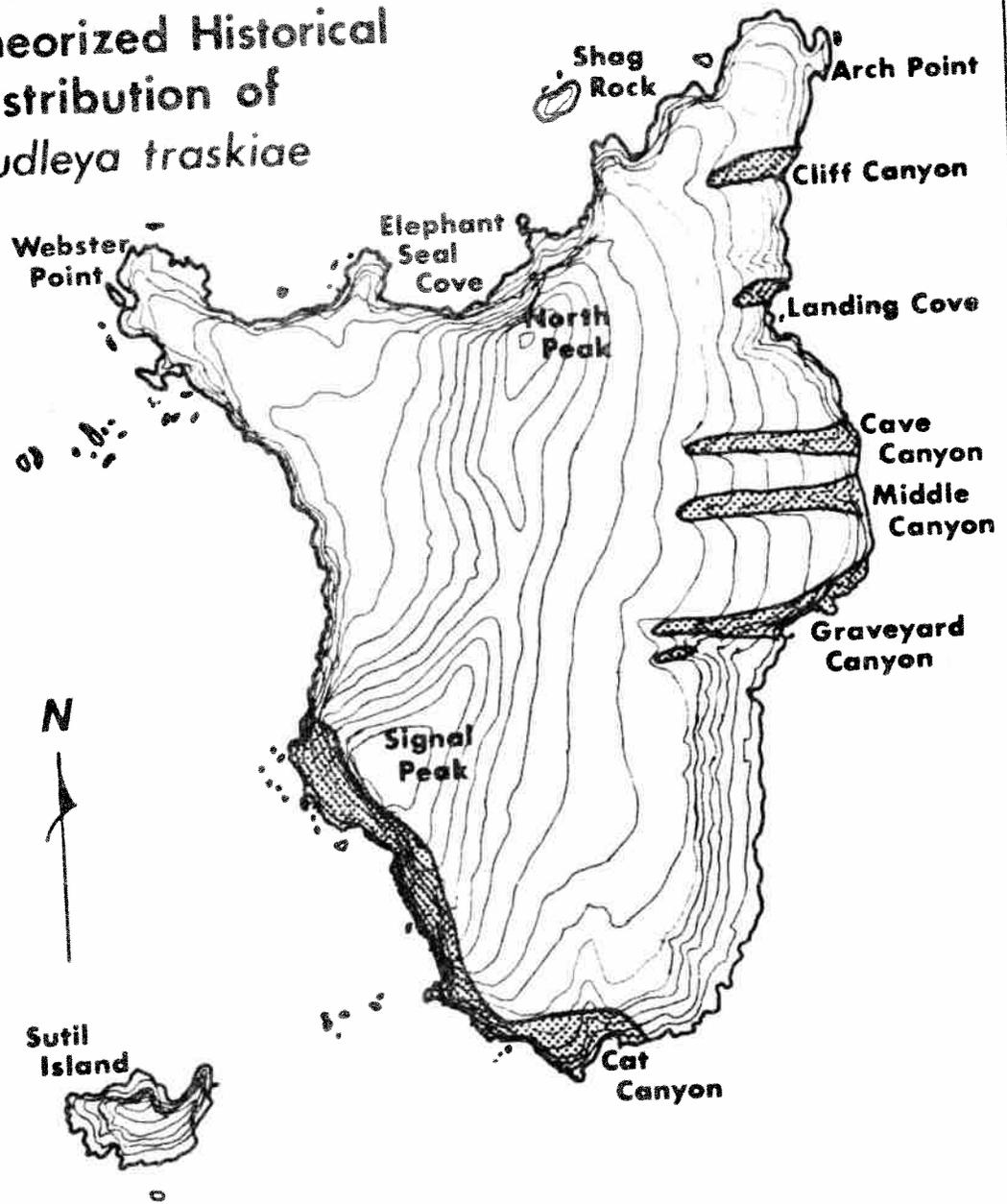
● Isolated Plants
■ Colonies (>5 mature plants)

0.5
km

The Santa Barbara Island liveforever now grows within community types Power (1979) defined as maritime cactus scrub and the sea-cliff phase of the coastal bluff community. Power suggested that maritime cactus scrub may be transitional to coastal sage scrub. Walter Westman (pers. comm., 21 November 1983)* disagrees with Power's assessment. It may be postulated that Dudleya traskiae may have been part of the coastal sage scrub community prior to the influence of man. If correct, it would extend the possible historic distribution of D. traskiae very little because coastal scrub occupies only a small area near Signal Peak. However, if maritime cactus scrub is a seral community climaxing in coastal sage scrub, then this would greatly expand both the potential or historical range of coastal sage scrub and possibly D. traskiae. Employing this successional scenario and the best available information on soils, slope, and aspect for the Santa Barbara Island liveforever, we developed a theorized historical distribution for the plant (Figure 3). This theorized distribution includes south- and southwest-facing slopes. These slopes harbor the sea-cliff phase of the coastal bluff association, and coastal sage scrub and maritime cactus on bare rock or shallow steep soils (lithic xerothent). Clearly, more information is needed on the precise ecological requirements of the species. This should be the subject of future studies to accurately determine suitable habitat, if not the historic range, for D. traskiae.

* Walter Westman, Professor of Geography, University of California, Los Angeles and expert on the dynamics of coastal sage scrub.

FIGURE 3
Theorized Historical
Distribution of
Dudleya traskiae



Theorized Historical Distribution



Historic Impacts and Current Threats

Philbrick in a 1972 article cataloguing the flora of Santa Barbara Island, described man's impact on the vegetation, including Dudleya traskiae. The direct and indirect effect of various activities of European man reshaped the vegetation of the small island. A brief description of known and speculated impacts on the distribution of the liveforever by man, adapted from Philbrick (1972) and other information is summarized below.

Although Indians inhabited or at least visited Santa Barbara Island, their impact on the vegetation is unknown and the subject of speculation. Indians employed fire in much of coastal and interior California (Lewis 1973) and they probably used fire on the Channel Islands (Johnson 1980). The abundant charcoal in the paleosols of San Miguel Island documents the effect of fire on the vegetation of the Channel Islands. Indians probably caused most of the prehistoric fires on Santa Barbara Island because of the rarity of natural ignition sources (e.g., lightning) (Keeley 1982). Yet the absence on Santa Barbara Island of fire-adapted chaparral species (e.g., Adenostoma, Ceanothus) and presence of coastal sage scrub taxa may suggest fire was infrequent. Because coastal sage scrub taxa do not necessarily require fire for reproduction, fire is not mandatory for maintenance of this community (Westman 1982) that may have historically harbored the dudleya. The typical habitat of many dudleyas and the endangered liveforever, steep rocky open slopes, suggests that the genus and the Santa Barbara Island liveforever fare

poorly in more densely vegetated areas where fire may occur more frequently.

Indians also may have directly impacted the liveforever. Aboriginal man may have actually foraged for and consumed Dudleya traskiae. Although no supporting evidence exists for this impact involving D. traskiae, D. saxosa was considered a delicacy by the Cahuilla Indians (Clarke 1977). Jepson (1936) mentioned that D. saxosa was used by early prospectors. In light of the absence of fresh water on Santa Barbara Island and the succulent leaves of D. traskiae, this does not seem unreasonable. Nonetheless, the acidity of liveforever leaves in general makes it unlikely the species was used to any significant degree.

The island in 1849 was "densely populated with goats" that were introduced prior to 1846 (Philbrick 1972). Feral goats (Capra hircus) can inflict severe damage to natural vegetation (Coblentz 1980). They are generally much more destructive than other herbivores because goats can subsist on forage of lesser quality, often bitter-tasting plants. In addition, goats trample vegetation and their behavioral characteristics enable them to use more of the plant biomass within a given area than other herbivores (Coblentz 1980). Goats on Santa Catalina Island and sheep on Santa Cruz Island were found to be especially fond of the vegetation within the coastal sage scrub community (e.g., Artemisia californica). Evidently these feral animals selectively removed or reduced Artemisia from several parts of those islands (Wheeler 1876, Brumbaugh 1980, Coblentz 1980). If this

scenario occurred on Santa Barbara Island as well, it could account for the random and sporadic nature of the distribution of sage on the island. Moreover, this might further support the belief that the coastal maritime scrub is transitional to coastal sage scrub. The transitional nature of maritime scrub to sage scrub was noted by Brumbaugh (1980). He reported that coastal sage scrub, especially Artemisia, regenerated in a few years within sheep exclosures on Santa Cruz Island. Thus, the rugged and near inaccessibility of the remnant coastal sage scrub community and the largest liveforever colony on the southwest slope of Signal Peak might be explained as a form of a goat "exclosure".

Hobbs (1980) suggested that feral goats on the Channel Islands selected against the soft-stemmed shrubs typical of coastal sage scrub and for spinose shrubs like cactus (Opuntia littoralis and O. prolifera). Therefore, because Dudleya traskiae was probably associated with Artemisia, goats may have had a profound impact on the distribution of D. traskiae. They may have reduced the number of the liveforever and California sage, especially in accessible portions of the island, via trampling and grazing. The goats evidently ignored the cactus, now abundant over much of the island. Although goats were eliminated prior to the advent of extensive farming around 1915, they may have significantly influenced the current range and abundance of D. traskiae even prior to the discovery of the species around the turn of the century.

Exotic vegetation, particularly aggressive weedy species, has greatly influenced the vegetation of Santa Barbara Island (Philbrick 1972). Infamous ubiquitous weeds like goosefoot (Chenopodium murale), iceplant [Gasou] (= Mesembryanthemum crystallinum) and cheeseweed (Malva parviflora) were first recorded from the island around the turn of the century (Philbrick 1972). Subsequently, visiting botanists noted numerous introduced or weedy California species on the island. Among the more notorious and aggressive plants on Santa Barbara Island are wild oats (Avena barbata and A. fatua), red brome (Bromus rubens), Australian saltbush (Atriplex semibaccata), pepper-grass (Lepidium nitidum), bur-clover (Medicago polymorpha), filaree (Erodium cicutarium and E. moschatum), fiddleneck (Amsinckia intermedia) and sow-thistle (Sonchus oleraceus and S. tenerrimus) (see appendix for species list).

The past and present competitive effects of exotic grasses and herbs can neither be discounted nor quantified with any certainty. Nonetheless, Philbrick (1972) discussed at length the rapid colonization of much of the island by iceplant. During the period of active farming and ranching (1915-26), island residents cleared much of the island of giant coreopsis (Coreopsis gigantea) and iceplant, and planted barley. Iceplant employs a mechanism that enables it to invade and dominate coastal grassland by accumulating salt in the soil (Vivrette and Muller 1977). As a result, iceplant invaded even the wild oat field which formerly was the barley field (Philbrick 1972). It eventually covered "50 percent or more of the island" until an accidental fire in 1959 burned two-thirds of the island. Although

Gasoul can be seen scattered over much of the island, it still largely covers the top of the Signal Peak. The 1959 fire evidently reduce the dominance of the weed. This suggests fire may be employed in the control or eradication of this exotic plant.

The introduction in 1942 of "New Zealand Red" rabbits (Oryctolagus cuniculus), a breed of Old World rabbit, affected the already altered vegetation of Santa Barbara Island (Philbrick 1972). Although Belgian hares, another breed of Old World rabbit, were brought to the island in 1915, they evidently were extirpated by feral housecats introduced prior to 1900. The "New Zealand Red" breed, however, exploded in the early 1950's reaching a peak population of an estimated 2,621 animals in 1955 (Philbrick 1972). After the designation of the island as part of the Channel Islands National Monument in 1938, unofficial rabbit shooting occurred. In October of 1954, the Park Service began a rabbit control program, that continued until very recently. Park Service personnel (Charles Drost, pers. comm., 7 November 1983)* believe now that the rabbits have finally been eliminated from Santa Barbara Island as of 7 August 1981. Evidence of herbivory (e.g., nipped leaves, removed seedlings) of the liveforever by rabbits was not noted when Fish and Wildlife Service personnel visited the island in late August of 1981.

Native plants of the island, especially giant coreopsis, sagebrush, box thorn (Lycium californicum), and morning glory (Calystegia

*Charles Drost, Biologist, Channel Islands National Park, Ventura, California.

macrostegia), suffered severe impacts resulting from rabbit herbivory (Philbrick 1972). Some exotic species, like iceplant, expanded their range and numbers under this grazing pressure. Historical accounts described a denuded landscape with rabbits "crouched in plain sight" (Philbrick 1972). Although these historical accounts fail to record Oryctolagus feeding on dudleya, both rabbits and native deer mice (Peromyscus maniculatus) were observed feeding on the liveforever by biologists from the Santa Barbara Museum of Natural History (Power 1979). National Park Service personnel further confirmed the use of dudleya by mice in 1983 (Drost, pers. comm. 7 November 1983). In addition, they noted that 30 to 40 percent of the fruiting peduncles of Dudleya traskiae were gnawed through and broken.

The powdery bloom covering many of the rosette leaves of the liveforever presumably assists in the collection of dew. This trait together with the succulent inflorescence and leaves of the species and absence of open fresh water on the island might make the dudleya a favored target for herbivory. Additionally, this herbivory may be more severe during drought years. Nevertheless, the actual effects of herbivores on Dudleya traskiae are unknown.

Most of the information contained in historical accounts on Dudleya traskiae are either too vague or reportedly erroneous to determine the historic status of the liveforever. For example, Meryl Dunkle (1942) reported that two species of Echeveria (Dudleya) grew on the island.

He noted that what he identified as E. greeni grew in only one locality, while E. albida was "occasional" on Santa Barbara Island. Dunkle probably confused the two foliar races (glaucous and non-glaucous) of D. traskiae (Philbrick 1972). Regardless, the distributional data reported by Dunkle are too vague to even assess population trends let alone threats to the liveforever. Moran (1943) described only "two colonies, one on the south slope and one on the west, both at about 100 m elevation." These data, although also vague, would tend to support a contention that the plant was rare even prior to the explosion of Old World rabbits in the early 1950's. The generally held contention that the rabbits were the threat to the species seems questionable. Even with the removal of the rabbits, fire and exotic vegetation remain as potential threats to the species.

Although the eradication of the rabbits from the island by the Park Service was essential to the recovery of Dudleya traskiae (Moran 1978, Power 1979, Philbrick 1980), the removal of the rabbits does not by itself recover the species. An apparent absence of seedlings within known populations noted by Fish and Wildlife personnel in 1981 suggests a more severe and complicated problem. Although the National Park Service noted nearly 100 "seedlings" near mature plants in the spring of 1983, the long-term survival of these small dudleyas remains in doubt. The extremely wet winter of 1982-83 may have greatly influenced seedling establishment, producing essentially atypical results. In light of the few seedlings (24) observed by National Park Service employees the following year, the large number of seedlings recorded

in 1983 may indeed be unusual. Demographic data do not now exist to show population trends, either positive or negative, for the species. In addition, the 1984 survey only tallied 673 total liveforevers; hardly suggestive of an abundant species.

Past and Current Conservation Efforts

Most actions affecting the Dudleya traskiae have been primarily designed to restore natural processes and remove external sources of disturbance on Santa Barbara Island. These actions include the following:

1. All vehicles were removed from Santa Barbara Island.
2. All visitors are restricted to a designated trail system, camp area, and landing cove. Off-trail exploration is not allowed.
3. Trails have been removed from the biotically sensitive Cave and Middle Canyons.
4. Rabbit populations subjected to sporadic control efforts since 1954, were eradicated on 7 August 1981.
5. Seasonal restrictions on trails open for use, and other specific restrictions are used to avoid possible detrimental effects to sensitive species such as the endangered California brown pelican (Pelicanus occidentalis californicus).

Santa Barbara Island is managed under a policy of total protection of all island features, both cultural and natural, along with allowance for public visitor enjoyment of these resources. Among facilities of the island to aid these efforts are a trail system of approximately 10.4 km (6½ miles), a small campground, and a ranger station. Visitation of the island is relatively light (5,945 visits in 1980) and occurs primarily on summer weekends.

Recently, the National Park Service proposed to research the autecology of Dudleya traskiae. The work will be done by personnel from the Channel Islands National Park who will examine the general habitat of all ten populations and precisely map each site. The populations will be monitored seasonally as well as yearly to determine changes in the status of the species. Seed production and viability will be examined by collecting mature seed from the plants on the island. The National Park Service recognizes the need for a permit pursuant to Section 10(a) of the Endangered Species Act for this particular activity. Seedlings of the dudleya will be grown in a greenhouse to compare seed production and viability of the cultivated plants to those in the wild. These data, it is hoped, will assist in the recovery of the liveforever.

Planned and approved management actions for Santa Barbara Island by the National Park Service are described below. The following management plans are available to the public from the National Park Service:

- 1) General Management Plan Volume 1, Visitor Use/Interpretation/General Development. Channel Islands National Park, California. Sept. 1980. Volume 1 outlines the management objective for Anacapa, Santa Barbara and San Miguel Island. In addition, acceptable levels of visitors use, interpretation, and general development (recreational) are discussed in the plan.
- 2) General Management Plan Volume 2, Natural/Cultural Resource Management. Channel Islands National Park, California. Sept. 1980. This volume provides management guidance for the preservation of the natural and cultural resources of Anacapa, Santa Barbara, and San Miguel Island.
- 3) Natural and Cultural Resource Management Program, an addendum to the General Management Plan. Channel Islands National Park, California. Sept. 1980. This document presents the cultural and natural resources management program proposed for the next five years.

Although many of the management efforts undertaken by the National Park Service benefit the liveforever, additional refinement of the various management plans and programs may be necessary to adequately protect, manage, and recover Dudleya traskiae.

PART II RECOVERY

Objective

The prime objective of this recovery plan is to secure all colonies of the Santa Barbara Island liveforever in a vigorous self-sustaining condition, expand the distribution of the plant to include 95 percent of the suitable potential habitat on the island, and delist the species. Criteria for identifying suitable habitat will be determined following studies detailed in later portions of this recovery plan. When the species occupies 50 percent of the suitable habitat on the island and all colonies are vigorous, self-sustaining, and protected, consideration may then be given to reclassifying the species to threatened.

Many of the past threats that reduced the liveforever to its present low numbers have been eliminated or greatly reduced by the National Park Service. No substantial data exist to indicate that the plant is expanding its current limited range into potential habitat. Population numbers remain low for the liveforever. Exotic vegetation, collection, and wildfire still threaten the dudleya. Because little is known of the ecology of the plant, it is difficult to plan for its recovery and management.

The establishment of the plant on 95 percent of the suitable habitat on the island is a justifiable and probably an attainable goal.

Reproductive biology, time, and available monies will dictate the success of such an effort. The figures of 95 and 50 percent are flexible numbers and subject to change as new information is evaluated.

Step-down Outline

Prime objective: Secure all colonies of the Santa Barbara Island liveforever in a vigorous self-sustaining condition, expand the distribution of the plant to include 95 percent of the suitable habitat on the island, and delist the species. Criteria for identifying suitable habitat will be determined following the completion of studies. When the species occupies 50 percent of the suitable habitat on the island, and all colonies are vigorous, self-sustaining, and protected, consideration may be given to reclassifying the species to threatened.

1. Protect the Santa Barbara Island liveforever and its habitat from physical disturbance.
 11. Prohibit development that may detrimentally affect suitable and/or occupied habitat of the liveforever.
 12. Minimize human disturbance on the island.
2. Enhance the liveforever and its habitat.
 21. Establish liveforever colonies.
 211. Outplant liveforever seedlings on the island in suitable and/or occupied habitat.
 212. Determine suitable habitat of the liveforever.
 213. Propagate the liveforever from seed collected from the island.
 214. Collect seed of the liveforever from the island.
 22. Implement exotic plant removal program.
 23. Remove exotic herbivores from the island.

24. Manage the liveforever as a result of recommendations derived from studies.
 241. Monitor the liveforever colonies.
 242. Examine reproductive biology of the liveforever.
 243. Evaluate the need for other autecological studies of the liveforever and undertake as necessary.
3. Protect the liveforever from collection.
 31. Enforce State and Federal laws pertaining to the liveforever.
 32. Evaluate the success of law enforcement.
 33. Propose appropriate new regulations and revisions.
4. Develop and implement an educational/informational program to facilitate recovery of the liveforever.
 41. Prepare and distribute a pamphlet and audio-visual program discussing the liveforever and the biota of the island, especially other endangered and threatened species.
 42. Conduct naturalist programs discussing the liveforever and the biota of the island, especially the endangered and threatened species.

Narrative

Prime objective: Secure the Santa Barbara Island liveforever in a vigorous self-sustaining condition, expand the distribution of the plant to include 95 percent of the suitable habitat on the island, and delist the species. When the species occupies 50 percent of the suitable habitat, and all colonies are vigorous, self-sustaining, and protected, consideration may be given to reclassifying the species to threatened.

1. Protect the Santa Barbara Island-liveforever and its habitat from physical disturbance.

The existing colonies and habitat of the liveforever must be maintained and protected. The few remaining individuals in the wild must be vigilantly protected from human impacts.

11. Prohibit development that may detrimentally affect suitable and/or occupied habitat of the liveforever.

The National Park Service via its Natural and Cultural Resource Management Program and General Plan has determined that no further development of the island will occur. This action prevents any developmental degradation of the habitat of the liveforever and retains all options for recovering the undeveloped portions of the island.

12. Minimize human disturbance on the island.

The National Park Service via the aforementioned program and plan has undertaken activities to minimize human impacts to the island. It is their policy to protect all island features, both natural and cultural, including the liveforever. Moreover, all hiking on the island is restricted to the existing approved system of 10.4 km of trails. The only exception to the hiking restrictions will be for approved studies or recovery plan actions.

2. Enhance the liveforever and its habitat.

To facilitate recovery, the numbers and colonies of liveforever must be increased. Moreover, these expanded colonies of the species must be self-maintaining. The few remaining individuals of the liveforever, fewer than 700 plants, and apparent lack of significant recruitment explain the need for this task.

21. Establish liveforever colonies.

The small colonies and few individuals of the dudleya necessitate a program of outplanting of liveforever to establish viable colonies. The apparent lack of significant seedling recruitment makes this necessary for recovery of the species.

211. Outplant liveforever seedlings on the island in suitable and/or occupied habitat.

The small population size, fewer than 700 individuals of the liveforever, may necessitate a program of outplanting of seedlings to establish viable population levels or new colonies. The outplanting effort, if undertaken, may require trial and error to determine appropriate planting techniques. Moreover, care should be taken to avoid introducing other exotic plants while any outplanting effort occurs. Moran noted the necessity for outplanting of seedlings in 1978 in his work with the species. The potential need for this action was further substantiated when FWS biologists failed to note any young plants or seedlings in a visit to the island in 1981. Although the National Park Service reported seeing approximately 99 seedlings in 1983 and 24 seedlings in 1984, the fate of these plants remains questionable due to their placement next to larger mature plants. Significant numbers of seed-derived liveforever plants could be outplanted, if necessary, on the island in appropriate locations within suitable habitat to expand existing population or establish new colonies. The correct season for establishment would be late autumn or winter.

212. Determine suitable habitat of the liveforever.

An improved understanding of the present distribution of the liveforever with other data derived from studies detailed in task 243 should assist in identifying suitable habitat of the species. This information is needed prior to any outplanting of liveforever. Examination of the distribution of the species might also focus on the dynamics of the plant community(ies) which harbor(s) the liveforever. The precise edaphic and microclimatic (microhabitat) requirements of Dudleya traskiae should also be determined.

213. Propagate the liveforever from seed collected from the island.

The plants should be cultivated from seed by nursery personnel knowledgeable in the cultivation of Dudleya or other Crassulaceous plants. Seed should be gathered from wild plants from the island to avoid genetic contamination in light of the propensity of the genus to hybridize.

214. Collect seed of the liveforever from the island.

Seed for propagation should be collected in the late summer from selected dried inflorescences. Care

should be taken to collect as little seed as possible from any given area and only what seed is needed for the propagation of a few seedlings annually (ca. 100-500).

22. Implement exotic plant removal program.

The National Park Service proposed to eradicate iceplant and annual grasses via a feasibility project slated to take three years. Although this activity will not directly affect the liveforever, it may eventually permit the establishment of the species on "reclaimed" areas.

23. Remove exotic herbivores from the island.

Aside from the historic consumption of liveforever plants by "New Zealand Red" rabbits, other exotic herbivores (e.g., murid rodents, garden snails) may be introduced and could negatively affect the liveforever. Action will be undertaken if it is deemed necessary by the National Park Service and Fish and Wildlife Service.

24. Manage the liveforever as a result of recommendations derived from studies.

Aside from the recovery actions detailed above, other tasks may be needed to enhance or promote the recovery of the

plant. For example, a pollinator of the liveforever may be "threatened" or absent and, therefore, corrective actions may be needed.

241. Monitor the liveforever colonies.

Because of the anticipated annual recruitment of seedlings in the spring and potential loss of seedlings and older plants throughout the year, the species should be monitored annually to detect any trends in the population (i.e., survivorship, recruitment). These annual monitoring data may forewarn of any pending crisis regarding the liveforever. These data will be demographic in nature, employing the most efficient and innocuous techniques available. Moreover, the individuals performing this study should be qualified and available for several years to ensure continuity and/or quality control.

242. Examine reproductive biology of the liveforever.

Although closely interrelated with the demographic/monitoring effort discussed above (241), work detailing the floral biology, especially pollinators, is needed. These studies will not only determine what, if any, animals or physical factors

(i.e., wind) facilitate pollination, but will also examine the need for cross-pollination. Moreover, this research will examine the flower production, gamete development, and mating pattern of the species to determine the quantity and quality of seed production, and effectiveness of the pollinators. These data together with reliable test estimates of seed viability are necessary to ascertain the effectiveness of seed set for the liveforever. Without sufficient annual seed production, the species would not be self-sustaining.

243. Evaluate the need for other autecological studies of the liveforever and undertake as necessary to determine suitable habitat.

Because of the need to determine suitable habitat for the liveforever, autecological studies are necessary. These studies will focus on the competitive and colonization abilities of Dudleya traskiae to determine the preferred habitat of the species. These studies will utilize microhabitat mapping techniques to assist in this effort. Other studies or techniques may include research involving herbivores (snails, mice), allelopathic plants, sensitive or candidate species, and other related subjects. Other potential studies include phenological research of the liveforever or the

nature of environmental adaptations. For example, the distribution and frequency of glaucous and non-glaucous foliar races of the liveforever should be examined as this probably affects outplanting and other recovery efforts. These studies will be undertaken as necessary according to available data.

3. Protect the liveforever from collection.

Because fewer than 700 plants remain in the wild, liveforever individuals must not be disturbed, via removal or collection. This need is further intensified by the high collectability of the dudleya, because of its extreme rarity and succulent habit. The recent addition of Dudleya traskiae to the CITES appendices underscored this collection threat.

31. Enforce State and Federal laws pertaining to the liveforever.

The laws that might afford protection for the liveforever include the Endangered Species Act, Convention of International Trade in Endangered Species, Lacey Act, and State of California Native Plant Protection Act. These and other laws, where appropriate, and National Park Service regulations (36 CFR, Part 2, Section 2.1), should be vigilantly enforced to protect the liveforever.

32. Evaluate the success of law enforcement.

The success of the various laws and their enforcement should be periodically evaluated to determine the effectiveness of the protection program. This is necessary to ensure that the species is adequately protected.

33. Propose appropriate new regulations and revisions.

If, after the evaluation of the law enforcement program it becomes evident that additional or new regulations and revisions are needed, these measures should be proposed. This is necessary to ensure that the species is adequately protected.

4. Develop and implement an educational/informational program to facilitate recovery of the liveforever.

The public should be informed about the plight of the endangered Santa Barbara Island liveforever. Such a program will not only benefit this recovery effort, but will serve to increase the public's awareness of the common causes of species endangerment and biotic impoverishment. The protection of habitat and recovery of the species will remain difficult tasks unless the public is aware of the ecological, historical, and aesthetic importance of conserving endangered species.

41. Prepare and distribute a pamphlet and audio-visual program discussing the liveforever and the biota of the island, especially other endangered and threatened species.

To ensure that the public is adequately informed about the liveforever and the other biota of the island, a pamphlet and audio-visual program should be developed discussing these points. Both should emphasize the liveforever and the need for its protection as well as the other endangered species. An account of the now extinct Santa Barbara Island song sparrow also might be meaningful to emphasize the need for public involvement.

42. Conduct naturalist programs discussing the liveforever and the biota of the island, especially the endangered and threatened species.

To ensure that the public is adequately informed about the liveforever and the other biota of the island, the National Park Service should conduct naturalist programs discussing these points. The programs should emphasize the liveforever and the need for protection of it as well as the other endangered species on the island. The habitat of the liveforever should not be traversed or impacted by the visitors or naturalist. These people should remain on the established trails.

Literature Cited

- Britton, N., and J. Rose. 1903. New or noteworthy North American Crassulaceae. Bull. New York Bot. Gard. 3:1-45.
- Britton, N., and J. Rose. 1905. Crassulaceae. In North American flora, Vol. 22, Part 1, Pp. 7-74. New York Bot. Gard., New York.
- Brumbaugh, R. W. 1980. Recent geomorphic and vegetal dynamics on Santa Cruz Island, California. In D. M. Power (ed.). The California islands: Proceedings of a multidisciplinary symposium. Pp. 139-158. Santa Barbara Museum of Natural History, Santa Barbara, Calif.
- Clarke, C. B. 1977. Edible and useful plants of California. Univ. Calif. Press, Berkeley, Calif.
- Coblentz, B. E. 1980. Effect of feral goats on the Santa Catalina Island ecosystem. In D. M. Power (ed.). The California islands: Proceedings of a multidisciplinary symposium. Pp. 167-170. Santa Barbara Museum of Natural History, Santa Barbara, Calif.
- Dunkle, M. B. 1942. Flora of the Channel Islands National Monument. Bull. S. Calif. Acad. Sci. 41:125-137.

- Hobbs, E. 1980. Effects of grazing on the northern populations of Pinus muricata on Santa Cruz Island, California. In D. M. Power (ed.) The California islands: Proceedings of a multidisciplinary symposium. Pp. 159-165. Santa Barbara Museum of Natural History, Santa Barbara, Calif.
- Jepson, W. L. 1936. Flora of California. Vol. II. Associated Students Store, Univ. Calif., Berkeley, Calif.
- Johnson, D. L. 1980. Episodic vegetation stripping, soil erosion, and landscape modification in prehistoric and recent historic time, Santa Miguel Island, California. In D. M. Power (ed.). The California islands: Proceedings of a multidisciplinary symposium. Pp. 103-121. Santa Barbara Museum of Natural History, Santa Barbara, Calif.
- Keeley, J. E. 1982. Distribution of lightning- and man-caused wildfires in California. In C. E. Conrad and W. C. Oechel (tech. coords). Proceedings of the symposium on the Dynamics and Management of Mediterranean-Type Ecosystems. Pp. 431-437. USDA Gen. Tech. Rep. PSW-58. Washington, D. C.
- Lawrence, G. H. M. 1951. Taxonomy of vascular plants. MacMillan Publishing Co., New York.
- Lewis, H. T. 1973. Patterns of Indian burning in California: ecology and ethnohistory. Ballena Press Anthropol. Papers, No. 1, Ramona, Calif.

- Moran, R. V. 1942-43. A revision of Dudleya subgenus Stylophyllum. Desert Plant Life. 14:190-193; 15:9-14, 24-28, 40-45, 56-60.
- Moran, R. V. 1951. A revision of Dudleya. Ph.D. dissertation, Univ. Calif., Berkeley, Calif.
- Moran, R. V. 1978. Resurrection of Dudleya traskiae. Fremontia 5 (4):37-38.
- Mulroy, T. W. 1976. The adaptive significance of epicuticular waxes in Dudleya (Crassulaceae). Ph.D. dissertation, Univ. Calif., Irvine, Calif.
- Mulroy, T. W. 1979. Spectral properties of heavily glaucous and non-glaucous leaves of a succulent rosette-plant. Oecologia 38:349-357.
- Munz, P. A. 1935. Manual of southern California botany. Claremont Colleges, Claremont, Calif.
- Munz, P. A. 1959. A California flora. Univ. Calif. Press, Berkeley, Calif.
- Munz, P. A. 1974. A flora of southern California. Univ. Calif. Press, Berkeley, Calif.

- Philbrick, R. N. (ed.). 1967. Proceedings of the symposium on the biology of the California islands. Santa Barbara Bot. Garden, Santa Barbara, Calif.
- Philbrick, R. N. 1972. The plants of Santa Barbara Islands, California. *Madrono* 21:329-393.
- Philbrick, R. N. 1980. Distribution and evolution of endemic plants of the California islands. In D. M. Power (ed.). The California islands: Proceedings of a multidisciplinary symposium. Pp. 173-187, Santa Barbara Museum of Natural History, Santa Barbara, Calif.
- Power, D. M. (ed.). 1979. Natural resources study of the Channel Islands National Monument. Published report produced by the Santa Barbara Museum of Natural History, contract no. CX-2000-8-0040.
- Ryti, R. T. 1984. Perennials on rock islands: Testing for patterns of colonization and competition. *Oecologia* 64:184-190.
- Terri, J. A. 1984. Seasonal variation in crassulacean acid metabolism in Dudleya blochmanae (Crassulaceae). *Oecologia* 64: 68-73.
- Tolken, H. R. 1977. A revision of the genus Crassula in southern Africa. *Contr. Bolus Herb.* No. 8.

- Uhl, C. H. 1948. Cytotaxonomic studies in the subfamilies Crassuloideae, Kalanchoideae, and Cotyledonoideae of the Crassulaceae. *Amer. J. Bot.* 35:695-706.
- Uhl, C. H. 1963. Chromosomes and phylogeny of the Crassulaceae. *Cact. Succ. J. (U.S.)* 35(3):80-84.
- Vivrette, N. J., and C. H. Muller. 1977. Mechanism of invasion and dominance of coastal grassland by Mesembryanthemum crystallinum. *Ecol. Mono.* 47:301-318.
- Westman, W. E. 1982. Coastal sage scrub succession. In C. E. Conrad and W. C. Oechel (tech. coords.) Proceedings of the symposium on the Dynamics and Management of Mediterranean-Type Ecosystems. Pp. 91-99. USDA Gen. Tech. Rep. PSW-58. Washington, D.C.
- Wheeler, G. M. 1876. Annual report upon the geographical surveys west of the one hundredth meridian in California, Nevada, Utah, Colorado, Wyoming, New Mexico, Arizona, and Montana. U.S. Govt. Printing Office, Washington, D.C.

PART III IMPLEMENTATION SCHEDULE

The schedule that follows is a summary of actions and costs for the Santa Barbara Island liveforever recovery program. It is a guide to meet the objective of the Recovery Plan, as elaborated in Part II, Narrative Section. This table indicates the general category for implementation of recovery plan tasks, corresponding outline number, priority, duration of the tasks, which agencies are responsible to perform the tasks, and the estimated costs to perform the tasks. Implementing Part III is the action of the recovery plan that when accomplished will bring about the recovery of this Endangered species.

GENERAL CATEGORIES FOR IMPLEMENTATION SCHEDULES

Information Gathering - I or R (research) Acquisition - A

- | | |
|-------------------------------|-------------------------|
| 1. Population status | 1. Lease |
| 2. Habitat status | 2. Easement |
| 3. Habitat requirements | 3. Management agreement |
| 4. Management techniques | 4. Exchange |
| 5. Taxonomic studies | 5. Withdrawal |
| 6. Demographic studies | 6. Fee title |
| 7. Propagation | 7. Other |
| 8. Migration | |
| 9. Predation | |
| 10. Competition | |
| 11. Disease | |
| 12. Environmental contaminant | |
| 13. Reintroduction | |
| 14. Other information | |

Management - M

Other -

- | | |
|---|------------------------------|
| 1. Propagation | 1. Information and education |
| 2. Reintroduction | 2. Law enforcement |
| 3. Habitat maintenance and manipulation | 3. Regulations |
| 4. Predator and competitor control | 4. Administration |
| 5. Depredation control | |
| 6. Disease control | |
| 7. Other management | |

RECOVERY ACTION PRIORITIES

Priority 1= An action that must be taken to prevent extinction or to prevent the species from declining irreversibly.

Priority 2= An action that must be taken to prevent a significant decline in species population/habitat quality, or some other significant negative impact short of extinction.

Priority 3= All other actions necessary to provide for full recovery of the species.

PART III IMPLEMENTATION SCHEDULE
SANTA BARBARA ISLAND LIVE-FOREVER

General Category	Plan Task	Task Number	Task Priority	Task Duration (Yrs.)	Responsible Agency		Fiscal Year Costs (Est.) (in \$1,000's)			Comments/Notes
					FWS Region	Other Agencies	FY 1	FY 2	FY 3	
M3	Prohibit development within suitable and/or occupied liveforever habitat	11	1	Ongoing		NPS*	Unable to determine			NPS costs are part of existing management and essentially inseparable
M3	Minimize human disturbance on the island	12	1	Ongoing		NPS*	Same as above			Same as above
M2	Outplant liveforever seedlings on island	211	2	3	1	SE	2.5	2.5	2.5	To be completed FY-4
I 13	Determine suitable habitat of the liveforever	212	2	1		NPS*	12			Based on studies detailed in task 242.

Abbreviations

- * - Lead Agency
- CDFG - California Department of Fish and Game
- NPS - National Park Service
- OSA - Office of Scientific Authority (FWS)
- SE - Endangered Species Office (FWS)
- Continuous - Tasks that will continue once they are initiated
- Ongoing - Tasks now being implemented

General Category	Plan Task	Task Number	Task Priority	Task Duration (Yrs.)	Responsible Agency		Fiscal Year Costs (Est.) (in \$1,000's)			Comments/Notes	
					FWS Region	Other Agencies	FY 1	FY 2	FY 3		
M1	Propagate the live-forever from seed collected on the island	213	2	3	1	SE*	NPS*	5	5	5	To be completed FY-4
M1	Collect seed of the liveforever on the island	214	2	3	1	SE	NPS* CDFG	0.1 0.5 0.1	0.1 0.5 0.1	0.1 0.5 0.1	
M3	Implement exotic plant removal program	22	3	3			NPS*	5	5	5	NPS has reported this as a three year task
M4	Remove exotic herbivores from the island	23	1	1			NPS*	To be determined			Exotic rabbit removal program completed
I1	Monitor colonies the liveforever	241	2	Continuous Ongoing	1	SE	NPS*	0.5 2	0.5 2	0.5 2	Some of this work for NPS is ongoing from FY-2
I7	Examine reproductive biology of the liveforever.	242	2	Continuous	1	SE	NPS*	To be determined			

General Category	Plan Task	Task Number	Task Priority	Task Duration (Yrs.)	Responsible Agency		Task	Fiscal Year Costs (Est.) (in \$1,000's)			Comments/Notes
					FWS Region	Other Agencies		FY 1	FY 2	FY 3	
I10	Evaluate the need for other autecological studies of the live-forever and undertake as necessary	243	3	Continuous	1	SE		To Be Determined			
02	Enforce State and Federal laws	31	1	Continuous	1	LE* SE OSA		0.1 0.1 0.1	0.1 0.1 0.1	0.1 0.1 0.1	
					9	OSA	NPS	1	1	1	
02	Evaluate the success of law enforcement	32	2	Continuous	1	LE* SE OSA		0.1 0.1 0.1	0.1 0.1 0.1	0.1 0.1 0.1	
					9	OSA	NPS	0.1	0.1	0.1	
03	Propose appropriate new regulations and revisions	33	2	Continuous	1	SE OSA		0.1 0.2	0.1 0.2	0.1 0.2	
01	Prepare and distribute pamphlet and audio-visual program	41	3	1	1	SE	NPS*		1.0 1.0		
01	Conduct naturalist programs	42	3	Continuous	1	SE	NPS*		0.5 0.5		
							NPS*	3	3	3	

APPENDIX

Vascular Plants of Santa Barbara Island

<u>Scientific name</u>	<u>Vernacular name</u>
<u>Achillea millefolium</u> E	common yarrow
<u>Amblyopappus pusillus</u>	amblyopappus
<u>Amsinckia intermedia</u>	common fiddleneck
<u>Amsinckia spectabilis</u>	seaside fiddleneck
<u>Aphanisma blitoides</u>	aphanism
<u>Apiastrum angustifolium</u>	wild celery
<u>Artemisia californica</u> var. <u>insularis</u>	island coastal sage
<u>Astragalus traskiae</u> **	Trask's milk-vetch
<u>Atriplex californica</u>	California saltbush
<u>Atriplex pacifica</u>	Pacific saltbush
<u>Atriplex semibaccata</u> E	Australian saltbush
<u>Avena barbata</u> E	slender wild oats
<u>Avena fatua</u> E	wild oats
<u>Baccharis pilularis</u> subsp. <u>consanguinea</u>	coyote brush
<u>Brassica nigra</u> E X	black mustard
<u>Bromus arizonicus</u>	Arizona brome
<u>Bromus diandrus</u> E	ripgut grass
<u>Bromus mollis</u> E	soft chess

<u>Bromus rubens</u> E	red brome
<u>Bromus trinii</u>	Chilean brome
<u>Calandrinia ciliata</u> var.	redmaids
<u>menziesii</u>	
<u>Calandrinia maritima</u>	seaside calandrina
<u>Calystegia macrostegia</u> subsp.	Santa Barbara Island
<u>amplissima</u> *	morning-glory
<u>Camissonia cheiranthifolia</u> Q	beach evening-primrose
<u>Cannabis sativa</u> E X	marijuana
<u>Caulanthus lasiophyllus</u>	California mustard
<u>Centaurea melitensis</u> E	tocalote
<u>Chenopodium californicum</u>	soap plant
<u>Chenopodium murale</u> E	nettle-leaf goosefoot
<u>Claytonia perfoliata</u>	miner's lettuce
<u>Conyza bonariensis</u> E	flax-leaved fleabane
<u>Conyza canadensis</u> E	horseweed
<u>Cotula australis</u> E	Australian cotula
<u>Coreopsis gigantea</u>	giant coreopsis
<u>Crassula erecta</u>	sand pygmy-weed
<u>Cryptantha clevelandii</u> var.	Cleveland's cryptantha
<u>clevelandii</u>	
<u>Cryptantha maritima</u>	Guadalupe cryptantha
<u>Daucus pusillus</u> E	rattlesnake weed
<u>Dichelostemma pulchellum</u>	blue dicks
<u>Dudleya traskiae</u> *	Santa Barbara Island
	liveforever
<u>Eriogonum giganteum</u> var.	Santa Barbara Island
<u>compactum</u> *	buckwheat

<u>Eriophyllum nevinii</u>	silver-lace
<u>Erodium cicutarium</u> E	redstem filaree
<u>Erodium moschatum</u> E	whitestem filaree
<u>Eschscholzia ramosa</u>	island bush poppy
<u>Eucrypta chrysanthemifolia</u>	common eucrypta
<u>Filago californica</u>	California filago
<u>Galium aparine</u> E	common bedstraw
<u>Galvezia speciosa**Q</u>	island snapdragon
<u>Gasoul crystallinum</u> E	crystalline iceplant
<u>Gasoul nodiflorum</u> E	slender-leaved iceplant
<u>Gilia nevinii</u>	Nevin's gilia
<u>Gnaphalium bicolor</u>	Bioletti's cudweed
<u>Gnaphalium californicum</u>	green everlasting
<u>Hemizonia clementina</u>	Catalina tarweed
<u>Hemizonia fasciculata</u>	fascicled tarweed
<u>Hesperocnide tenella</u>	western nettle
<u>Hordeum glaucum</u> E	blue foxtail
<u>Hordeum pusillum</u>	little barley
<u>Hymenolobus procumbens</u>	prostrate hutchinsia
<u>Lamarckia aurea</u> E	goldentop
<u>Lasthenia chrysostoma</u>	goldfields
<u>Lepidium nitidum</u> var. <u>nitidum</u>	shining pepper-grass
<u>Lolium perenne</u> E	Italian ryegrass
<u>Lotus argophyllus</u> subsp. <u>ornithopus</u>	silver deerweed
<u>Lycium californicum</u>	California boxthorn

<u>Lycopersicon esculentum</u> E	tomato
<u>Malacothrix foliosa</u>	leafy malacothrix
<u>Malva parviflora</u> E	cheeseweed
<u>Marah macrocarpus</u>	wild cucumber
<u>Medicago polymorpha</u> E	bur clover
<u>Melica imperfecta</u>	Coast Range melic
<u>Melilotus indica</u> E	Indian melilot
<u>Microseris linearifolia</u>	uropappus
<u>Mirabilis californica</u>	wishbone bush
<u>Monolepis nuttalliana</u>	Nuttall's monolepis
<u>Muhlenbergia microsperma</u>	annual muhly
<u>Oligomeris linifolia</u>	oligomeris
<u>Opuntia littoralis</u>	coastal prickly pear
<u>Opuntia oricola</u>	Philbrick's cholla
<u>Opuntia prolifera</u>	coastal cholla
<u>Parapholis incurva</u> E	sickle grass
<u>Parietaria hespera</u>	pellitory
<u>Perityle emoryi</u>	rock-daisy
<u>Phacelia</u> aff. <u>floribunda</u> (<u>distans</u> ?)	island phacelia
<u>Phalaris minor</u>	Mediterranean canary grass
<u>Pholistoma auritum</u> var. <u>auritum</u>	common fiesta flower
<u>Pholistoma racemosum</u>	San Diego fiesta flower
<u>Phyllospadix scouleri</u>	Scouler's surf-grass
<u>Phyllospadix torreyi</u>	Torrey's surf-grass
<u>Plantago ovata</u> E	Old World plantain

<u>Platystemon californicus</u> var.	Santa Barbara Island
<u>ciliatus</u> *	cream cups
<u>Polypodium californicum</u>	California polypody
<u>Polypogon monspeliensis</u> E	rabbits-foot grass
<u>Pterostegia drymarioides</u>	fairy mist
<u>Rafinesquia californica</u>	California chicory
<u>Silene gallica</u>	windmill pink
<u>Silybum marianum</u> E	milk-thistle
<u>Sonchus oleraceus</u> E	common sow-thistle
<u>Sonchus tenerrimus</u> E	slender sow-thistle
<u>Spergularia macrotheca</u> var.	large-flowered sand
<u>macrotheca</u>	spurry
<u>Spergularia bocconii</u> E	Boccone's sand spurry
<u>Stipa pulchra</u>	purple needle grass
<u>Stylomecon heterophylla</u>	wind poppy
<u>Suaeda californica</u>	sea-blite
<u>Trifolium palmeri</u>	Palmer's clover
<u>Trifolium tridentatum</u>	tomcat clover
<u>Vulpia myuros</u> var. <u>hirsuta</u> E	foxtail fescue
<u>Vulpia octoflora</u>	six weeks fescue
<u>Xanthium spinosum</u> E X	spiny clotbur

- * Santa Barbara Island endemic taxon, either Federally listed or candidate plant
- ** Federal candidate plant
- X Extirpated from Santa Barbara Island
- Q Questionable record from Santa Barbara Island
- E Exotic taxon

APPENDIX

Agencies Requested to Provide Comments During Agency Review -

Director
California Department of Fish and Game
1416 Ninth Street
Sacramento, California 95814

National Park Service
Point Reyes National Seashore
Pt. Reyes, California 94956

Park Superintendent
Channel Islands National Park
1901 Spinnaker Drive
Ventura, California 93001

Regional Director
National Park Service
450 Golden Gate Avenue
PO Box 36063
San Francisco, California 94102



12



