

**City of San Diego
Multiple Species Conservation Program**

**Summary of Monitoring Results for
Dudleya blochmaniae ssp. *brevifolia***

May 2004

Introduction

Short leaved dudleya (*Dudleya blochmaniae* ssp. *brevifolia*) is listed by the State of California as an endangered plant species. The five known occurrences of this extremely rare plant in the City of San Diego are Carmel Mountain, Del Mar Heights (Crest Canyon), Skeleton Canyon (UCSD), Torrey Pines State Park, and Torrey Pines State Park Extension. This plant is a perennial herb that typically blooms between April and June.

The surveys conducted are listed in Table 1 below. The methodology and results of the monitoring are detailed below. The goal of the effort was to continue long-term monitoring of short-leaved dudleya under the Multiple Species Conservation Program (MSCP).

Table 1: Dudleya Monitoring Surveys Dates

Date	Location	Surveyors
May 7, 2004	Skeleton Canyon, Crest Canyon	Holly Cheong
May 13, 2004	Carmel Mountain	Holly Cheong, Keith Greer, Khalil Martinez, Byron Frohn

Methodology

Monitoring for this species was conducted in accordance with the Biological Monitoring Plan for the Multiple Species Conservation Program (Monitoring Plan), dated January 25, 1996. Monitoring for this species began in 1999 on the Carmel Mountain site. In 2001, all survey sites were mapped using a sub-meter GPS. Each site was remapped during the 2002 and 2003 monitoring seasons.

During the data collection process, every effort was made to avoid stepping on the sensitive plants. Only one person counted the plants to lower the amount of foot traffic where the plants were growing. The individual counting the plants made every attempt to step on rocks or other areas where plants would not be located. Another person recorded the data while remaining outside the occupied habitat area to avoid additional impacts from trampling. The methodology is described by site below.

Carmel Mountain

Three separate sampling areas (subpopulations 1 through 3) were delineated on Carmel Mountain during the 1999 surveys (see attached map). In 2001, an additional subpopulation of small size was located on a mesa adjacent to subpopulation 1. In 2003, another population was found adjacent to subpopulation 2. The location of each sampling area was determined by field level surveys and then depicted on aerial photographs.

The sampling areas were measured in 1999. Transects were selected randomly in 1999 and steel rods were installed to indicate the location of each transect. The transects are of varying lengths. The total number of transects (N=19) installed in all three sampling areas was determined by the

total number of quadrats (N=64) required to sample approximately 5% of the total area of all three sampling areas. A census of the new small subpopulation was also conducted.

All fixed transects were located and string was run along the transect route. A one-meter square (1 m^2) quadrat was used to define the quadrat boundary and estimate population size. The 1 m^2 quadrat was placed along the left side of the transect. Each plant located within the 1 m^2 quadrat was counted and the total number for each quadrat was recorded. Quadrats were placed at 1 m intervals along each transect.

Crest Canyon

In 2004, all plants within Crest Canyon on the southern mesa were counted. For the northern mesa, presence/absence surveys were conducted. The limits of the populations on both mesas were mapped using a sub-meter GPS in 2003.

Skeleton Canyon

In 2004, all plants within Skeleton Canyon were counted. The limits of the population were mapped using a sub-meter GPS in 2003.

Torrey Pines

Surveys at Torrey Pines were not conducted this year. In previous years, the boundaries of the population was mapped but no attempt was made to estimate the size of the population due to time constraints and to avoid damaging the population. The Torrey Pines population is managed by California State Parks and all mapping from previous years has been provided to them in digital format. That information may be compared to any future surveys conducted by California State Parks.

Results

Carmel Mountain

Data from the monitoring effort are shown on the attached monitoring data forms. It is estimated from the results of the transect method that approximately 18,907 individuals of short-leaved dudleya were on Carmel Mountain in 2004. Of those individuals, 2,258 individuals occur within subpopulation 1 (flowering and non-flowering), 1,710 individuals occur within subpopulation 2 (all flowering), and 14,939 individuals occur within subpopulation 3, (flowering and non-flowering). In comparison, approximately 27,000 individuals were found on Carmel Mountain in 1999, 23,500 individuals in 2000, 66,637 in 2001, 1,446 in 2002 and 113,134 in 2003. Results from the last five years of monitoring are given in Table 1 below.

Table 1: Subpopulation and Population Estimates for Carmel Mountain and Rainfall by Year

	1999	2000	2001	2002	2003	2004
Subpopulation 1	10,024	11,385	23,656	521	36,429	2,258
Subpopulation 2	493	1,566	5,580	34	22,274	1,710
Subpopulation 3	16,800	10,536	37,337	891	54,431	14,939
Total Population Estimate	27,317	23,487	66,637	1,446	113,134	18,907
Rainfall (inches) October – June*	6.5	5.7	8.6	3.0	10.4	4.2

*Source: http://meteora.ucsd.edu/wx_pages/climatology.html

The results of monitoring continue to suggest that dudleya is significantly affected by rainfall. As shown in Table 1, the population numbers tends to vary greatly from year to year and seem to correlate with rainfall levels.

Given the variable numbers of this species from year to year, MSCP staff evaluated the number of years it would take to be able to detect a significant difference in the population using the US Geological Service (USGS) online computer program called Monitor. Given the results from the past five years of monitoring on the Carmel Mountain site, it was calculated that five years of surveys would have a 62% chance of correctly detecting a 10% population increase, a 73% chance of correctly detecting a 10% population decrease, and 53% chance of detecting no change in the population. Monitor also determined that after additional five years of surveys (ten years total) using the transect/quadrat method, surveyors would have a 86% chance of correctly detecting a 10% population increase, a 100% chance of correctly detecting a 10% population decrease, and 46% chance of detecting no change in the population.

Crest Canyon

A total of 10 individuals were counted on the southern mesa of Crest Canyon in 2004. All individuals found were flowering. In 2003, 120 individuals were counted on the southern mesa. No individuals were found in 2002, while 53 flowering individuals were found on the southern mesa in 2001.

On the northern mesa, only presence/absence surveys were conducted in 2004. All individuals observed were flowering. In 2003, 12,825 individuals were estimated on the northern mesa. In 2002, dudleya was not observed. In 2001, the population size was estimated to be 2,629 individuals using the organisms-to-nearest neighbor distance method. Given that randomly allocated quadrats were used to estimate the population in 2003 and the organisms-to-nearest neighbor distance method (which may be unreliable for this species) was used in 2001, it is unlikely that the population estimates from these two years are comparable.

Skeleton Canyon

Only one flowering individual of short-leaved dudleya was observed in Skeleton Canyon in 2004. 191 individuals were observed in 2003. No individuals were found in 2002, while in 2001, 62 flowering individuals were counted.

Conclusions

The 2004 monitoring season showed decreased numbers of short-leaved dudleya within the City of San Diego consistent with previous years of lower rainfall. Due to drought conditions that persisted throughout the growing season and, due to the lack of significant rainfall, a smaller amount of dudleya emerged and produced flowers in 2004 than in 2003 when rainfall was relatively high. Short-leaved dudleya numbers demonstrated recovery during 2003—an average rainfall year—from the previous drought.

Populations that occur along active trails systems showed evidence of impacts and appeared to be sparser than more isolated populations. However, fences and active management appear to minimize impacts. There did not appear to be extensive impacts to the Torrey Pines State Park population which is separated from a busy, active trail only by a split rail fence. Frequent ranger activity encourages people to stay on the existing trail as well. In contrast, the dudleya along the southern mesa of Crest Canyon borders a high traffic, unfenced trail. In previous years, many of the dudleya along that trail appeared to be trampled and the individuals found were sparse and infrequent.

Our data suggest that negative effects to the population can be reversed if the impacts are removed. Access to Carmel Mountain has been greatly reduced since development has precluded access from many of the surrounding communities. Dudleya can now be found growing within the trails in higher numbers where individuals were previously sparse; however, additional surveys are needed to verify this trend. In addition, future residential development is expected to increase pressure on the Carmel Mountain population.

Based on the results from Monitor (USGS), additional monitoring over time will increase the accuracy of change detection in the population trends at Carmel Mountain. Although population increases are more likely to be detected than population decreases, a greater number of monitoring years will not increase the probability of detecting no change in the population (see results above).

Recommendations

As mentioned above, every attempt was made to avoid trampling individuals. However, impacts to the plants still may occur during monitoring, especially in areas of higher population density. Alternative monitoring techniques which do not require stepping over the plants would protect against incidental impacts and decrease the difficulty of monitoring.

The sampling areas on Carmel Mountain should continue to be monitored to determine if the reduction of off-road vehicle use and other access will benefit the species over time. New transects can be placed in areas of population expansion in order to allow sampling of these areas in the future. However, current transect locations should remain to ensure that results are

comparable from year to year and to determine trends within the population. If population declines are detected in upcoming years, it may be necessary to prohibit equestrian use, mountain biking, and possibly hiking in the areas where the sampling areas are located. Barriers would need to be installed since many of the sampling areas occur along existing trails. If continued monitoring efforts suggest that the habitat can support additional individuals, enhancement of dudleya populations may also be beneficial.

MSCP staff recommends that sampling of plants be done exclusively at the Carmel Mountain site. As conducted this year, other sites would be surveyed for presence/absence but no sampling would occur unless a census could be easily conducted without damaging the population. This would help reduce damage to the populations which may occur during monitoring and also better allocate time for monitoring other endangered plant species. Presence/absence surveys can be done at Crest Canyon and Skeleton Canyon, noting any new disturbances or potential impacts each year. Presence/absence surveys, along with census counts at the smaller populations, are adequate to determine the annual status of the plant species at Crest Canyon and Skeleton Canyon. The Carmel Mountain site contains a significant population which can be sampled fairly easily and provides MSCP staff with an indication of the species status.

References

Krebs, Charles J. Ecological Methodology. 2nd ed. Addison-Wesley Pub Co., 1998.

Ogden Environmental. Biological Monitoring Plan for the Multiple Species Conservation Program. 1996.

Scripps Institute of Oceanography. The California Climatology Page.
http://meteora.ucsd.edu/wx_pages/climatology.html. Accessed on June 17, 2004.

U.S. Geological Survey. Monitor. Online Power Analysis Software.
<http://www.mp1-pwrc.usgs.gov/powcase/monitor.html>. Accessed on June 25, 2003.