

City of San Diego
Multiple Species Conservation Program

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

May 2000

Introduction

Short leaved dudleya (*Dudleya blochmaniae* ssp. *brevifolia*) is listed by the State Government as an endangered plant species. The only five known occurrences of this extremely rare plant 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.

Monitoring for this plant was conducted on May 9, 2000 by Keith Greer and Holly Boessow and May 27, 2000 by Holly Boessow, Keith Greer, Heather Bruce, and Bernard Turgeon. 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).

Methodology

Monitoring for this species was conducted in accordance with the Biological Monitoring Plan for the Multiple Species Conservation Program, dated January 25, 1996. Three separate sampling areas, designated sampling areas 1 through 3, were located on Carmel Mountain during the previous 1999 surveys (see attached figure). The location of each sampling area was determined by field level surveys and then depicted on aerial photographs. These areas were photographed both in 1999 and 2000. 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 total number of transects ($N=19$) installed in all three sampling areas was determined by the total number of quadrats ($N=63$) required to sample approximately 5% of the total area of all three sampling areas.

All transects were relocated except for one within sampling area two. This transect was replaced. Once the transects were relocated or replaced, string was run along the route of the transect. 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 transect so that the string bisected the quadrat. 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.

Clear hard plastic, otherwise known as lexan, was placed over 3 randomly selected quadrats. The location of individual plants were then drawn on the lexan in magic marker. Flowering adults were distinguished from non-flowering adults with different colored markers.

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 area of occupied habitat to avoid additional impacts from trampling.

Results and Conclusions

Data from the monitoring effort are shown on the attached monitoring data forms. It is estimated from the results of the transects that approximately 23,500 individuals of short-leaved dudleya were found on Carmel Mountain in the year 2000. In comparison, approximately 27,000 individuals were found on Carmel Mountain in 1999. Most of the individuals observed were in flower, but a small number of non-flowering individuals were also found. Since short-leaved dudleya is a perennial species, one would expect to see more than one life-stage represented in a population/sampling area. Every effort was made to locate juvenile and non-flowering adults. The surveyors were visually familiar with all stages of the plants' growth. Nevertheless, it is possible that the less obvious non-flowering adults and juveniles were present but missed during the survey since these growth stages tend to be more cryptic than flowering adults.

Additional annual surveys, both prior to and during the flowering period, will help determine if additional stages of the life cycle are indeed present, indicating a dynamic population, or if there is minimal or no seedling recruitment, indicating a stable population. Stable populations have a greater probability of going extinct over time due to their lack of recruitment. Surveys conducted during the spring before the flowering period will determine the total population size. Surveys will also be conducted in early summer during the flowering period to determine the number of flowering individuals.

The quadrats which were recorded in colored markers on lexan will be used in next year's monitoring to determine if plant locations are changing dramatically. Dramatic changes in plant locations may indicate that the dudleya population on Carmel Mountain is more dynamic than previously thought.

Of the three sampling areas which occur on-site, sampling areas 1 and 3 are fairly large (approximately 10,000 to 11,000 individuals per sampling area) and sampling area 2 is relatively small (approximately 1500 individuals). Sampling area 2 was located in an area on Carmel Mountain which appeared to be highly impacted by off-road vehicle use. Sampling areas 1 and 3, however, did not appear to be impacted by off-road vehicle use. Sampling area 1 is located approximately 1500 feet away from sampling areas 2 and 3. Sampling areas 2 and 3 are approximately 500 feet apart.

Sampling area 1 occurs off-trail adjacent to a very steep cliff, which may discourage off-road vehicle use. Sampling area 2 occurs on-trail where there are many road ruts and other evidence of off-road vehicle use. Sampling area 3 occurs on and also adjacent to a large trail on-site. There is not much evidence of off-road vehicle use within the sampling area 3 area, however, there is evidence of extensive equestrian use. Although plants were found growing directly on the trail, the density of plants appears to be higher adjacent to the trail than directly on the trail.

Recommendations

Since it appears that short-leaved dudleya prefers lower traffic areas. Currently, off-road use is prohibited on Carmel Mountain, but equestrian use, mountain biking, and hiking is not. Off-road vehicle use occurred on-site in the past but this illegal use has been reduced significantly by the recent installation of a gate. Additional gates may need to be installed as the surrounding lands get developed. The sampling areas on-site should continue to be monitored to determine if the reduction in off-road vehicle use will benefit the species overtime. If benefits are not seen within the few years it may be necessary to prohibited equestrian use, mountain biking, and possibly hiking in the areas where the sampling areas are located. Barriers would need to be installed since the sampling areas occur along existing trails. Enhancement of sampling area 2 may also be beneficial if it is determined over subsequent monitoring years that extensive disturbance is most likely the cause of the smaller population size.

It was intended to conduct two surveys this year; one survey during before the flowering period and another during the flowering period. However, surveys were conducted too late this year and the plants had already begun to flower. The monitoring schedule in subsequent years will be modified. Surveys will be conducted twice a year, once in spring before the flowering period and once in early summer during the flowering period. It will be assumed that the surveys conducted in the spring will estimate the total populations size whereas the surveys in early summer will only estimate the flowering population size (effective population size). Every effort will be made to locate juveniles and non-flowering adults during the summer survey. The results from the two surveys will then be analyzed and a determination will be made whether on not subsequent annual surveys will require two separate survey efforts.

As mentioned above, every attempt was made to avoid stepping on the sensitive plants. However, impacts to the plants still may occur during monitoring, especially in the areas that contain a higher density of plant species. A different monitoring technique which would not require stepping over the plants would protect the plants from incidental impacts and make monitoring less difficult. Use of photography may be incorporated into the monitoring effort to determine if photographs can be used to determine plant numbers without running traditional transects.

As previously mentioned, one transect within sampling area two could not be relocated. Many of the transects on-site were also bent. In order to avoid losing more transects to vandalism or other factors, the transects will be surveyed in using a Geographic Positioning System (GPS) during the next survey effort in 2001.

Finally, next year UCSD and Torrey Pines State Park will be approached in order to gain access to other populations of short-leaved dudleya. This will help us obtain a more comprehensive understanding of the existing condition for all known populations of this species.

MONITORING DATA
FORMS

**FINAL SUMMARY FORM
COVERED PLANT SPECIES MONITORING**

COVERED SPECIES short-leaved dudleya
MONITORING LOCATION Carmel Mountain Sampling Area
MONITORING DATE 5-24-00

I. POPULATION DENSITY

NUMBER OF INDIVIDUALS SAMPLED = 572
AREA SAMPLED = 18 m²
NUMBER OF QUADRATS = 18

DENSITY OF AREA SAMPLED = $\frac{\text{NUMBER OF INDIVIDUALS}}{\text{AREA SAMPLED}} = \frac{572}{18} = \underline{31.8 \text{ individuals/m}^2}$

II. POPULATION SIZE

POPULATION SIZE = TOTAL AREA OF POPULATION X DENSITY
= 358 m² X 31.8 = 11384.4

III. AGE CLASS STRUCTURE

AGE CLASS STRUCTURE = $\frac{\text{NUMBER OF QUADRATS IN WHICH THE AGE CLASS OCCURS}^{(1)}}{\text{TOTAL NUMBER OF QUADRATS SAMPLED}}$

SEEDLINGS _____ %

JUVENILES _____ %

FLOWERING ADULTS 83 %

NONFLOWERING ADULTS 50 %

NOTES:

⁽¹⁾ Refer to field data collection form for number of quadrats in which each age class occurs and the total number of quadrats sampled.

FINAL SUMMARY FORM **COVERED PLANT SPECIES MONITORING**

COVERED SPECIES short leaved dudleya
 MONITORING LOCATION Carmel Mountain Subpopulation 2
 MONITORING DATE 5/24/00

I. POPULATION DENSITY

NUMBER OF INDIVIDUALS SAMPLED = 412
 AREA SAMPLED = 8m²
 NUMBER OF QUADRATS = 8

DENSITY OF AREA SAMPLED = $\frac{\text{NUMBER OF INDIVIDUALS}}{\text{AREA SAMPLED}}$ = 51.5 individuals/m²

II. POPULATION SIZE

POPULATION SIZE = TOTAL AREA OF POPULATION X DENSITY
 = 80.4 m² X 51.5 = 1565.6

III. AGE CLASS STRUCTURE

AGE CLASS STRUCTURE = $\frac{\text{NUMBER OF QUADRATS IN WHICH THE AGE CLASS OCCURS}^{(1)}}{\text{TOTAL NUMBER OF QUADRATS SAMPLED}}$

SEEDLINGS %

JUVENILES %

FLOWERING ADULTS 100 %

NONFLOWERING ADULTS 50 %

NOTES:

⁽¹⁾ Refer to field data collection form for number of quadrats in which each age class occurs and the total number of quadrats sampled

FINAL SUMMARY FORM COVERED PLANT SPECIES MONITORING

COVERED SPECIES

MONITORING LOCATION

MONITORING DATE

Short leaved dudleya
Carmel Mountain Subpopulation 3
5/24/00

I. POPULATION DENSITY

NUMBER OF INDIVIDUALS SAMPLED = 1085

AREA SAMPLED = 52 m²

NUMBER OF QUADRATS = 52

DENSITY OF AREA SAMPLED =

NUMBER OF INDIVIDUALS =
AREA SAMPLED

foil

13.7 individuals/m²

II. POPULATION SIZE

POPULATION SIZE = TOTAL AREA OF POPULATION X DENSITY
= 800 m² x 13.7 = 10960

III. AGE CLASS STRUCTURE

AGE CLASS STRUCTURE = $\frac{\text{NUMBER OF QUADRATS IN WHICH THE AGE CLASS OCCURS (1)}}{\text{TOTAL NUMBER OF QUADRATS SAMPLED}}$

SEEDLINGS _____ %

JUVENILES _____ %

FLOWERING ADULTS 9 %

NONFLOWERING ADULTS _____ %

NOTES:

(1) Refer to field data collection form for number of quadrats in which each age class occurs and the total number of quadrats sampled.

5/24/00

DATA REDUCTION FORM COVERED PLANT SPECIES MONITORING

COVERED SPECIES

short leaved dudleya

MONITORING LOCATION

Carmel Mountain Subpopulation 1

TOTAL AREA SAMPLED

358m²

NUMBER OF TRANSECTS

6TOTAL TRANSECT LENGTH 123.42 ft (37.52 m)

NUMBER OF QUADRATS

18TOTAL QUADRAT SIZE 18m²

TRANSECT NUMBER	NUMBER OF PLANTS	AGE CLASSES ¹			
		SEEDLING	JUVENILE	ADULT FL	ADULT NFL
1	144			143	1
2	94			92	2
3	243			241	2
4	100			100	0
5	0			0	0
6	31			31	0
7					
8					
9					
10					
11					
12					
13					
14					
15					
N	6			fc>	6
SUM	572			567	5
MEAN	95.3			\$22	0.83
STANDARD DEVIATION	196.60			194.87	2.2
VARIANCE	38651.34			37973.5	4.84

¹ADULT FL = ADULT FLOWERING; ADULT NFL = ADULT NONFLOWERING.

NOTES:

DATA REDUCTION FORM

COVERED PLANT SPECIES MONITORING

COVERED SPECIES

Short-leaved dudley $< 1 \mu$

MONITORING LOCATION

Carmel Mountain... Simulation 3

TOTAL AREA SAMPLED

800 m²

NUMBER OF TRANSECTS

//

TOTAL TRANSECT LENGTH

216.25 ft (80.94 m)

TOTAL QUADRAT SIZE

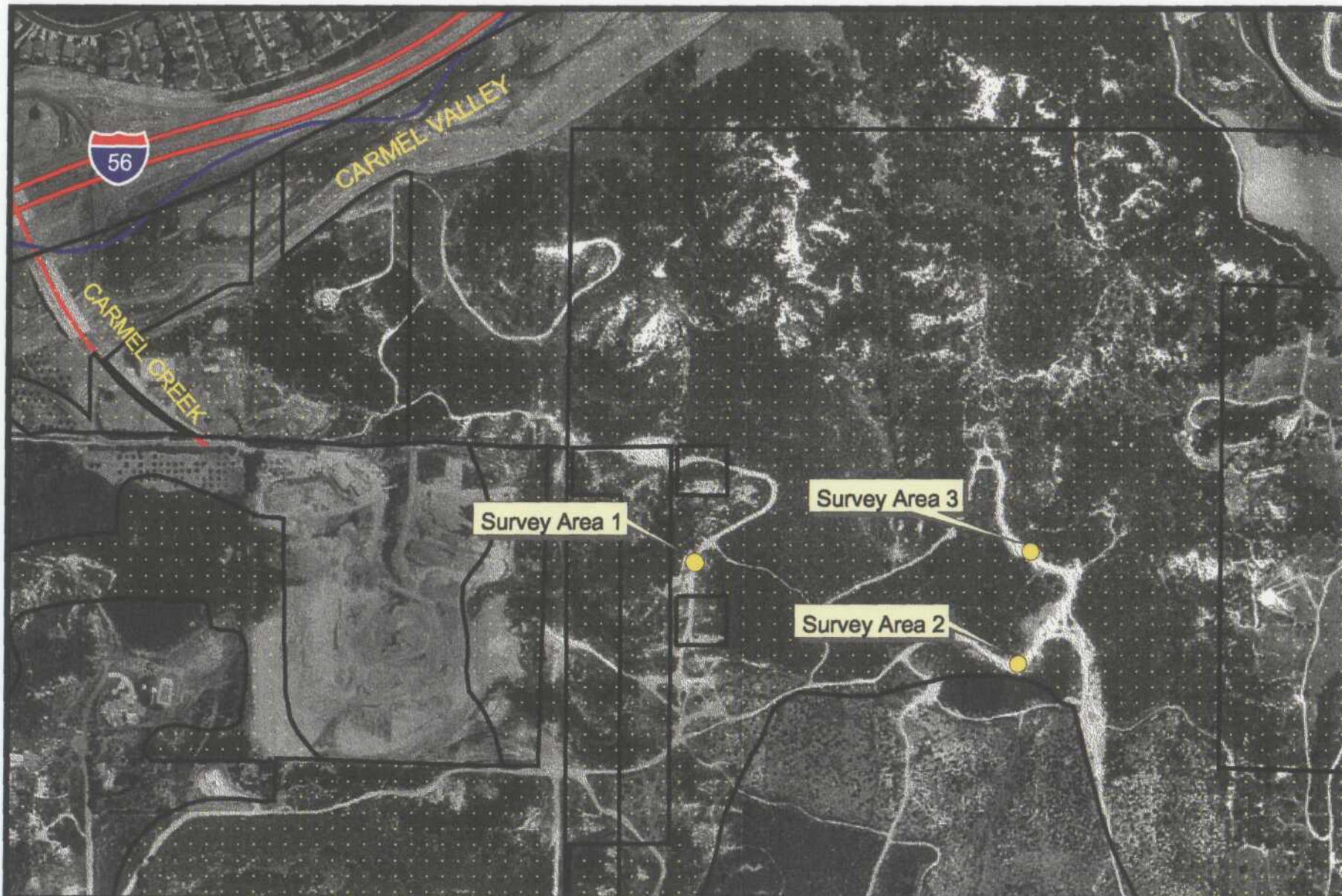
 52 m^2



TRANSECT NUMBER	NUMBER OF PLANTS	AGE CLASSES'			
		SEEDLING	JUVENILE	ADULT EL	ADULT NFL
1	78			78	
2	22			22	
3	41			50	
4	65			65	
5	0			0	
6	10			10	
7	85			85	
8	118			118	
9	79			79	
10	164			164	
11	23			23	
12					
13					
14					
15					
N	n				
SUM	685				
MEAN	62.3				
STANDARD DEVIATION	157.26				
VARIANCE	24732.19				

¹ADULT FL=ADULT FLOWERING; ADULT NFL=ADULT NONFLOWERING.

NOTES:

SURVEY LOCATION FIGURES



 Survey Areas
 MHPA

Carmel Mountain Survey

Dudleya blochmaniae ssp. *brevifolia*

Survey Date: 5-9-00 & 5-24-00

Source: H. Boessow, H. Bruce,
B. Turgeon, K. Greer

