

Variegated dudleya (*Dudleya variegata*)

on

San Diego National Wildlife Refuge

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Prepared by

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Introduction

Variegated dudleya [*Dudleya variegata* (Wats.) Moran] is an herbaceous perennial plant endemic to San Diego County and adjacent Baja California. It is considered a “covered” species under the Multiple Species Conservation Plan (MSCP): a habitat conservation plan formulated to support an incidental take permit pursuant to section 10(A)(1)(b) of the Act. The MSCP’s Biological Monitoring Plan considers this species a first-priority covered plant species, and stipulates that annual plants in this category are to be monitored by parties signatory to the MSCP every year. The U.S. Fish and Wildlife Service, as a participant in MSCP, manages and monitors wildlife on the refuges of the San Diego National Wildlife Refuge Complex, in accordance with the MSCP and federal guidelines governing refuge management.

In 2002, San Diego National Wildlife Refuge (SDNWR) personnel established five long-term monitoring grids on the refuge, roughly corresponding to the location “P-18” identified in the MSCP Biological Monitoring Plan (Ogden 1996). Grid coordinates are shown in table 1, and locations are illustrated in figure 1.

Table 1. Coordinates of *Dudleya variegata* monitoring grids on San Diego National Wildlife Refuge. Projection and datum are UTM NAD 83.

GRID	UTM E	UTM N
DV1	504514	3619997
DV2	502176	3617808
DV3	501528	3616725
DV4	502193	3617669
DV5	504127	3618676

Methods

Five 30 X 10 m grids were established by former SDNWR biologist Art Davenport in 2002, over known populations of *Dudleya variegata*. The grids were then subdivided into 300, 1 m² cells. Thirty cells were then selected randomly from the 300 available cells within the grid. Within each of the 30 cells, the number of flowering *D. variegata* were counted. In addition, the percent cover of rock, bare ground, moss, *Selaginella cinerascens*, *S. bigelovii*, *D. edulis*, *Eriogonum fasciculatum*, *Ferocactus viridescens*, European grasses (*Bromus* sp. and *Avena* sp.), and *Erodium* sp. was also collected for each of the 30 cells. The estimation of cover was calculated using a 1 m² sampling frame that had been subdivided into one hundred 10 X 10 cm cells.

In addition to the random sample of 30 cells, five 1 m² cells were permanently set to coincide with known concentrations of *D. variegata* within and adjacent to the 30 meter by 10 meter plot. Data collected in these non-random cells was the same as that collected in the random cells. Number of individual *D. variegata* in the non-random cells will be compared between years, using a Student's t-test.

Each year, 30 cells will be selected randomly from the 300 and monitored as described above. In addition, the five cells will be monitored on a yearly basis. Timing of monitoring will coincide with the presence of inflorescence (in bud or in flower). Number of individual *D. variegata* per randomly-selected cell will be compared between years, using a Student's t-test.

In 2005, I sampled at three of the five established grids (DV1, DV2, and DV5). I recorded numbers of *D. variegata* at three non-random cells (DV1 non-random cells 3 and 4, and DV4 non-random cell 2).

Results

In the 90 randomly selected grid cells sampled in suitable *D. variegata* habitat, I found a total of 39 individual plants.

There was no significant difference in the number of *D. variegata* per randomly selected cell in grids DV1 and DV2, between 2002 and 2005. Both numbers were zeros.

On grid DV5, there were significantly more *D. variegata* in 2003 (25) than in 2005 (0) (Student's t-test, P = 0.047)

None of the non-random cells identified in 2002 have been sampled more than twice. Numbers of *D. variegata* in non-random cells are presented in table 2.

Table 2. Numbers of *D. variegata* in non-random cells counted in at least two years, on San Diego National Wildlife Refuge.

Grid	Cell	2002	2005
DV1	3	8	119
DV1	4	10	123
DV4	2	5	3

Discussion

The extremely high rainfall in the winter of 2004-2005 may have contributed to the order-of-magnitude difference in numbers of *D. variegata* on non-random plots between 2002 and 2005. Even with the much higher numbers in 2005 than in previous years, it is evident that *D. variegata* is quite rare and patchily distributed. In 2005, in 90 randomly sampled 1 m² cells, the species was only found in two of them. Furthermore, 97% of the *D. variegata* found were in one 1- m² cell, and all of the plants found in sampled cells were in grid DV1. Descriptive statistics for *D. variegata* occurrence in the one occupied grid (DV1) (table 3) illustrate the patchy distribution of this plant.

Table 3. Descriptive statistics of number of *Dudleya variegata* per 1 m² grid cell, 20 April, 2005, on sampling grid DV1, San Diego National Wildlife Refuge.

Mean	1.3
Standard Error	1.265956
Median	0
Mode	0
Standard Deviation	6.933925
Sample Variance	48.07931
Kurtosis	29.95395
Skewness	5.471231
Range	38
Minimum	0
Maximum	38
Sum	39
Count	30

Notes on each sampling grid follow:

DV1: Sampled on 20 April 2005. Found the rebar with aluminum cap, marking one corner of the grid location. Based on the photograph that I had seen of this sampling grid in 2002, I assumed that the marker represented the southwest corner, and laid the grid out accordingly.

I could not determine from previous monitoring data which cells were the non-random plots. I found aluminum tags marking four of the five non-random plots, on the grid. However, only two of those tags were obviously fixed to sturdy objects such as rocks. The other two were lying in the vegetation, apparently not in the location where they were originally established. Therefore I only sampled two of the non-random plots. I also did not know whether the aluminum tags

denoted the center of a non-random plot, or the corner, and if so which corner. I assumed that they represented the center, based on the distribution of *D. variegata* surrounding the tag. Non-random plots were the only plots where I found substantial numbers of *D. variegata*. Of the 30 random plots, I recorded the target species on two of them, despite an apparently healthy population of *D. variegata* on the grid. That is to say, many more *D. variegata* occurred on the grid, but outside of the randomly sampled cells.

DV2: Sampled on 29 April, 2005. The lack of exotic grasses or thatch in the grid and immediate vicinity suggest suitable habitat for *D. variegata*. Lush growth of *Avena* occurred on most of the hillside, but not on grid DV2 or immediate vicinity. No *D. variegata* on grid, but about 15 *D. variegata* approximately 10 m south of grid. No markers were found for non-random plots, so any previously monitored non-random plots were not monitored in 2005. Because no *D. variegata* were found on the grid, no new non-random plots were established.

DV4: Non-random plot 2 was the only marker found on this sampling grid. Though only 3 flowering *D. variegata* were found within the sample plot, approximately 90 flowering *D. variegata* occurred within 3 m of the plot.

DV5: Sampled on 26 April, 2005. When this grid was sampled, *Muilla clevelandii* was about a week past peak bloom. No *D. variegata* were found on this grid in several visits, but a cluster of 10 plants was found within 20 m of the grid.

Literature cited

Ogden Environmental and Energy Services Co., Inc. 1996. Biological monitoring plan for the Multiple Species Conservation Program. Unpubl. plan prepared for City of San Diego, San Diego, California; California Department of Fish and Game, San Diego, California; and U.S. Fish and Wildlife Service, Carlsbad, California.

Figure 1. Locations of *Dudleya variegata* monitoring grids on San Diego National Wildlife Refuge.

