Western Riverside County
Multiple Species Habitat Conservation Plan (MSHCP)
Biological Monitoring Program

Delhi Sands Flower-loving Fly
(Rhaphiomidas terminatus abdominalis)
Survey Report 2011

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NOTE TO READER:

This report is an account of survey activities conducted by the Biological Monitoring Program for the Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP). The MSHCP was permitted in June 2004. The Monitoring Program monitors the distribution and status of the 146 Covered Species within the Conservation Area to provide information to Permittees, land managers, the public, and the Wildlife Agencies (i.e., the California Department of Fish and Game and the U.S. Fish and Wildlife Service). Monitoring Program activities are guided by the MSHCP species objectives for each Covered Species, the information needs identified in MSHCP Section 5.3 or elsewhere in the document, and the information needs of the Permittees.

MSHCP reserve assembly is ongoing and it is expected to take 20 or more years to assemble the final Conservation Area. The Conservation Area includes lands acquired for conservation under the terms of the MSHCP and other lands that have conservation value in the Plan Area (called public or quasi-public lands in the MSHCP). In this report, the term “Conservation Area” refers to the Conservation Area as understood by the Monitoring Program at the time the surveys were planned and conducted.

We would like to thank and acknowledge the land managers in the MSHCP Plan Area, who in the interest of conservation and stewardship facilitate Monitoring Program activities on the lands for which they are responsible. A list of the lands where data collection activities were conducted in 2011 is included in Section 7.0 of the Western Riverside County Regional Conservation Authority (RCA) Annual Report to the Wildlife Agencies. Partnering organizations and individuals contributing data to our projects are acknowledged in the text of appropriate reports.

While we have made every effort to accurately represent our data and results, it should be recognized that data management and analysis are ongoing activities. Any reader wishing to make further use of the information or data provided in this report should contact the Monitoring Program to ensure that they have access to the best available or most current data.

The primary preparer of this report was Monitoring Program Administrator, Adam Malisch. If there are any questions about the information provided in this report, please contact the Monitoring Program Administrator. If you have questions about the MSHCP, please contact the Executive Director of the RCA. Further information on the MSHCP and the RCA can be found at www.wrc-rca.org.

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INTRODUCTION

The Delhi Sands flower-loving fly (Rhaphiomidas terminatus abdominalis; DSF) is federally listed as endangered, and is narrowly distributed in portions of Riverside and San Bernardino Counties in areas with Delhi series soils. The species is currently known to occur, or to have occurred, within 3 Core Areas defined by the Western Riverside County MSHCP: Jurupa Hills, Agua Mansa Industrial Center, and Mira Loma (USFWS 1997, Dudek & Associates 2003). To date, conservation of the species within the MSHCP Plan Area has only occurred within the Jurupa Hills Core Area (Teledyne site). There are no lands that are currently part of the Conservation Area within the other 2 Core Areas for this species.

Species-specific objective 2 in the MSHCP states that successful reproduction shall be documented at all Core Areas once a year for the first 5 years after permit issuance and then as appropriate, but not less frequently than every 8 years thereafter (Dudek & Associates 2003). Reproductive success is defined in the MSHCP as the presence of pupal cases (exuviae) or newly-emerged (teneral) individuals. We describe here the procedure and results of the MSHCP Biological Monitoring Program’s 2011 effort to monitor DSF in the Jurupa Hills, both at the regularly-monitored Teledyne site and at a recently conserved property east of Teledyne, “Tax Sale 5”.

DSF has distinctive biological and habitat requirements and faces a number of threats (USFWS 1997). The life cycle of DSF includes egg, larval, pupal, and adult stages. Only the adult stage occurs above-ground, when adults emerge to breed during the summer months. DSF is restricted to fine, sandy Delhi series soils, usually with wholly- or partly-stabilized sand dunes and sparse native vegetation. Areas with suitable DSF habitat have been highly affected by anthropogenic activities, including conversion to agriculture, residential and commercial development, surface mining for sand, dumping of trash and cow manure, and damage by off-road vehicles. Invasive exotic plants are also thought to degrade DSF habitat by increasing vegetation cover or by altering soil conditions through dune stabilization and changes in soil moisture.

We began surveying for DSF at the Teledyne site in 2005. The primary goal of our survey was to evaluate if DSF was successfully reproducing; secondary goals were to estimate adult DSF detection probability and density and to gather data on DSF habitat associations. Detectability is important because the federal Recovery Plan for DSF requires information on population density and trends (USFWS 1997), which typically require associated detection probability estimates. Total DSF detections were relatively low from 2005 through 2007 and therefore did not allow us to model detection probability. We detected greater numbers of DSF in 2008, 2009, and 2010, allowing us to calculate reliable estimates of detection probability and density in those years.

Continuing to model detection probability along with abundance is important, as it will allow us to determine whether annual changes in the number of detections are due to changes in DSF abundance or changes in detectability. However, these metrics are not technically required in order to satisfy the DSF species-specific monitoring objective, as described above. Because gathering the data to calculate detection probabilities and annual abundance estimates requires significant resources and because the DSF
population at Teledyne appears to be stable or increasing (see Delhi Sands Flower-loving Fly Survey Report 2010), we postponed this more intense study design in favor of a less time-consuming survey aimed specifically at meeting the species-specific objective described above.

While the Teledyne site represents the only conserved land with suitable DSF habitat and a documented DSF population within the MSHCP-designated Core Areas, the Western Riverside County Regional Conservation Authority acquired an additional property just east of Teledyne in 2011. This property, designated “Tax Sale 5”, is located just north of Highway 60 and approximately 2.5 kilometers east of Teledyne (Figure 1). Despite the apparent lack of previously-mapped Delhi series soils (USDA et al. 1971, Soil Survey Staff et al. 2006) but because of the relatively close proximity to Teledyne, we surveyed the site opportunistically in 2011 to determine the potential presence of adult DSF and the suitability of the site for DSF.

Our focus for the 2011 field season was to efficiently meet the species-specific monitoring objective while reducing the personnel requirements demanded by previous study designs. We also wanted to begin working more closely with the MSHCP Management Program on an adaptive management approach to DSF habitat management at Teledyne. Finally, we wanted to assess the habitat at any recently acquired properties that may support DSF. Therefore, we established the following survey goals and objectives for 2011.

**Survey Goals and Objectives:**

1) Document successful DSF reproduction at the Teledyne site in the Jurupa Hills Core Area.
   a. Record observations of teneral individuals and/or exuviae.

2) Monitor the spread of short-pod mustard (*Hirschfeldia incana*) and non-native grasses (Poaceae) across the dune system at the Teledyne site.
   a. Record digital images annually from 3 photo stations to document changes in vegetation structure and composition.

3) Collaborate with the Management Program to develop an appropriate adaptive management strategy for the Teledyne site.

4) Conduct surveys at the newly-acquired Tax Sale 5 property to determine habitat suitability and presence of DSF.

**METHODS**

**Protocol Development**

We began surveying for DSF in 2005 following the *Interim General Survey Guidelines for the Delhi Sands Flower-loving Fly* (USFWS 1996). These guidelines were developed to determine presence/absence of DSF by slowly traversing appropriate habitat. We modified the USFWS protocol in 2005 by establishing line transects and measuring the perpendicular distance between the transect centerline and individual fly
Figure 1. Location of Teledyne and Tax Sale 5 Delhi Sands Flower-loving Fly Survey Sites.
Delhi Sands Flower-loving Fly Survey Report 2011

observations, with the goal of estimating population density and detection probability following distance sampling methodology (Buckland et al. 2001). We continued to use this basic protocol, with minor adjustments, to survey for DSF from 2006 - 2010. This survey method was thorough and systematic, covering the entire 6 ha at Teledyne, but time-consuming; in 2010 we spent approximately 268 person-hours conducting 67 site surveys across 39 days.

In 2011, we scaled back the survey effort to substantially reduce the personnel resources necessary while still gathering the required data to meet the given species-specific monitoring objective described above. The 2011 survey protocol consisted of untimed area searches within appropriate habitat at conserved sites either known to recently support adult DSF (Teledyne) or sites recently acquired that may contain suitable habitat (Tax Sale 5).

Personnel and Training

All field observers studied a DSF-specific training manual prepared by Biological Monitoring Program leads, relevant invertebrate field guides, and preserved specimens of co-occurring winged invertebrate species. We placed emphasis on the ability to recognize morphological and behavioral field traits of DSF, and proficiency in identifying all co-occurring winged insects to family. We also trained observers to differentiate between adult and teneral individuals, and to identify plant species common at the Teledyne site. All observers participated in field-based training that involved observing, capturing, and identifying co-occurring insects, excluding DSF. Field observers also passed the USFWS DSF practical exam and observed adult DSF in the field before participating in surveys.

Biological Monitoring Program personnel were funded by the California Department of Fish and Game or the Regional Conservation Authority. The following personnel conducted DSF surveys in 2011:

- Esperanza Sandoval (Biological Monitoring Program)
- Masanori Abe (Biological Monitoring Program)
- Jonathan Reinig (Biological Monitoring Program)
- Joseph Sherrock (Biological Monitoring Program)
- Lynn Miller (Biological Monitoring Program)
- Tara Graham (Biological Monitoring Program)

Study Site Selection

The Teledyne site is located in the Jurupa Hills along the Riverside-San Bernardino County border in the vicinity of Pyrite Street (Figure 1). The site encompasses just over 6 ha of Delhi series soils and is primarily composed of coastal sage scrub vegetation (Dudek & Associates 2003). Common plants found at the site include: *Eriogonum fasciculatum*, *Ambrosia acanthicarpa*, *Amsinckia menziesii*, *Rhus trilobata*, *Brassica* spp., *Croton californicus*, and various non-native grasses.

The Tax Sale 5 site is located just north of Highway 60 near the community of Sunnyslope, and covers roughly 52 ha of steep, hilly terrain along the western border of the Oak Quarry Golf Club (Figure 1). The area consists primarily of coastal sage scrub...
vegetation dominated by *Encelia farinosa* with *Artemisia californica*, *Eriogonum fasciculatum*, *Salvia mellifera*, *Rhus ovata*, *Stephanomaria* sp., as well as non-native annual grasses. The site also contains several large outcroppings of boulder/bedrock on hilltops and steep hill sides. Because of the scale and age of soils maps available, it was unclear if the Tax Sale 5 parcel contained Delhi series soils. However, due to the close proximity of this site to the only known DSF location (2.5 km from Teledyne), we considered it a high priority for on-the-ground habitat assessment and survey.

**Survey Methods**


Two surveyors simultaneously searched survey sites by walking within potentially suitable habitat at a slow pace and scanning for adult DSF in the air or perched on vegetation. Surveys were conducted between 1000 hrs and 1400 hrs during clear skies and low winds (< 5 mph). When we observed an adult DSF, we recorded UTM coordinates, time, sex, activity, and age class (adult / teneral) of the detected fly. If possible, we took photos of teneral DSF individuals. Surveyors took care to avoid disturbing any DSF individuals that were detected.

We established 3 permanent photo stations in 2006 to monitor the spread of *H. incana* and non-native grasses (Poaceae) across the dune system at the Teledyne site with digital images. These species may pose a threat to DSF habitat through dune stabilization (USFWS 1997). Results from previous years suggest that DSF were most abundant in areas that contain a high percentage of native vegetation and more than 60% open-sand substrate (USFWS 1997, also see *Delhi Sands Flower-loving fly Survey Report 2006*). We revisited photo stations in 2011, and took digital images in the 4 cardinal directions.

Beyond a strong affinity for Delhi series soils, DSF habitat associations have been difficult to determine, due either to few DSF detections or to relatively poor correlation between DSF presence and measured habitat features. Because previous efforts to establish useful quantitative correlations between DSF presence and habitat attributes have been both time-consuming and largely inconclusive, this effort was postponed in 2011. Future vegetation monitoring efforts will be initiated if a particular hypothesis requires testing, or pending direction from Reserve Managers, Permittees, or the Wildlife Agencies.

**Data Analysis**

The 2011 DSF surveys were designed to opportunistically determine presence of adult DSF at a given site. Because of the loosely defined survey area and lack of distance sampling data comparable to previous years’ efforts, the data are not suitable for typical data analysis. Thus, none was conducted.
RESULTS

We began 2011 surveys on 11 July and ended surveys on 19 August. We conducted 11 surveys at the Teledyne site and 3 surveys at the Tax Sale 5 site. Surveys lasted approximately 3 hours, and were conducted with 2 observers simultaneously. Accounting for travel time to and from Teledyne (0.5 hours each way), the total survey effort expended at Teledyne in 2011 was approximately 88 person-hours. We observed DSF during 8 surveys at Teledyne, documenting a total of 18 individual observations (10 males and 8 females). Two of these individuals were teneral, and we also recorded 1 exuviae, thus confirming reproduction at the Teledyne site in 2011.

We conducted 3 surveys at the Tax Sale 5 site but did not observe DSF, nor did surveyors note any suitable habitat for DSF at this location. The site consists primarily of coastal sage scrub vegetation with several large outcroppings of boulder/bedrock on hilltops and steep hillsides. The site was dominated by compacted loam with a thin layer of loose topsoil (2-3mm) but devoid of any areas with fine sands characteristic of the Delhi series soils. While conducting DSF surveys, biologists recorded incidental observations of 3 Covered Species: California gnatcatcher, Bell’s sage sparrow, and coastal western whiptail. Flying insects from the families Apidae, Sarcophagidae, Mutilidae, Odonata, and Pompilidae were also noted. Surveys lasted approximately 3 hours and were conducted with 2 observers simultaneously. Accounting for travel time to and from Tax Sale 5 (0.5 hours each way), the total survey effort expended to assess the habitat at this site and to search for adult DSF was approximately 24 person-hours.

We recorded digital images in the 4 cardinal directions at each of 3 previously established photo stations in 2011. These images are stored with those from previous years and will be used to qualitatively track vegetation changes through time and to visually show quantitative changes in vegetation through time if additional sampling is conducted in the future.

DISCUSSION

In 2011, the 7th year of DSF monitoring, our focus was to efficiently meet the species-specific monitoring objective while reducing the personnel requirements demanded by previous study designs. We also wanted to begin working more closely with the MSHCP Management Program regarding habitat management at Teledyne. Finally, we wanted to assess the recently-acquired Tax Sale 5 property near Teledyne for suitable DSF habitat that could potentially support DSF.

We confirmed DSF reproduction again at Teledyne in 2011, documenting 2 teneral individuals and an exuviae, with greatly reduced survey effort compared to recent years. We reduced the person-hours expended in 2011, as compared to those expended in 2010 by approximately 66% (88 person-hours compared to 268, respectively). Because we did not conduct enough surveys to gather the sample size of DSF observations needed to estimate density, we can not comment on the status of the DSF population at Teledyne in 2011 other than to confirm that reproduction occurred on site, and that the species was readily available for detection during surveys. Habitat assessment surveys at the Tax Sale
property in the Jurupa Hills showed that suitable DSF habitat did not appear to be present.

In the fall of 2011, after the adult DSF flight season had concluded, the MSHCP Management Program implemented habitat management activities at Teledyne to improve site conditions for DSF. The first management activity involved controlling erosion resulting from a fire break installed by fire fighters during a 2008 fire in the hills to the southeast of the dunes occupied by DSF. A small rut coming down from the fire break was depositing clay and loam soils onto the Delhi series soils on the dunes, thus decreasing available suitable habitat for DSF. Management Program workers installed water diversion obstacles composed of natural materials to divert the rainwater away from the dunes. Subsequent management actions planned for the Teledyne site consist of vegetation control measures designed to reduce the percent cover of vegetation especially non-native vegetation. These management actions are guided by, and conducted in accordance with, the Delhi Sands Flower-loving Fly Habitat Management Plan Jurupa Hills, Riverside County (Marchant 2005).

Recommendations for Future Surveys

The species-specific objective for DSF states that successful reproduction shall be documented at all Core Areas once a year for the first 5 years after permit issuance and then as appropriate, but not less frequently than every 8 years thereafter. The MSHCP permit was issued in 2004; therefore further surveys conducted to document successful reproduction of DSF at previously occupied sites are not strictly mandated, but shall be conducted as appropriate, and as personnel are available.

Continuing to model detection probability along with density is important, as it will allow us to determine whether changes in the number of detections are due to changes in DSF abundance or changes in detectability. We plan to periodically (at least once every 8 years, but ideally every 3-5 years) conduct the more demanding line transect study design that allows us to model detection probability and density in order to better describe population changes at occupied sites, especially as active habitat management continues. Unless otherwise directed, or precluded by staff availability, we will document reproduction at recently occupied sites and evaluate habitat at newly acquired sites annually.

There is an on-going need to better establish specific vegetation and soil requirements for DSF. Monitoring Program DSF reports in previous years have tentatively identified *A. menziesii*, *H. incana*, and stabilized sand as negatively associated with DSF presence, while bare ground and loose sand have been tentatively identified as positively associated, although results have been inconsistent across years. Perhaps above-ground vegetation and habitat conditions are not as important for adult DSF as subsurface habitat components (i.e., root structure, soil conditions, food sources) are for larval DSF. The overwintering larval stage is by far the longest in the DSF life cycle. Investigating subsurface habitat conditions is likely beyond the feasible scope of Monitoring Program activities as it is not essential in order to meet the listed monitoring objective and involves additional disturbance of habitat for this endangered species. Another possibility is that the mobility of adult DSF makes it difficult to properly place vegetation sampling plots. Our approach has been to center plots over areas where DSF
were observed perched. Many times, however, a DSF perches for only a few seconds before taking flight again. It is therefore unclear whether perched sites are better indicators of DSF habitat preference than other areas over which DSF are observed in flight.

While the number of DSF observations varies across the site, there are no large areas within the polygon of mapped Delhi series soils at Teledyne where DSF are not observed. Therefore, as suggested in previous reports, we may need to expand vegetation survey efforts beyond the borders of the DSF survey area to gather data from areas in which DSF do not occur. One strategy would be to sample small quadrats both within and outside of the DSF survey area. Another alternative would be to identify an area with few fly observations (within or adjacent to the DSF survey area) in which the vegetation could be manipulated experimentally. For example, *A. menziesii* could be removed from treatment plots. These plots could then be monitored for DSF and compared to control areas. Given the federally endangered listing status of DSF and the small size of the Teledyne site, careful planning would be required to avoid inadvertently damaging DSF habitat or individuals.

In addition to any vegetation sampling conducted in the future we will continue to record digital images at established photo stations to qualitatively monitor the status of invasive plants and changes in community structure at Teledyne.

**LITERATURE CITED**


Appendix A. Western Riverside County MSHCP Biological Monitoring Program Protocol for Delhi Sands Flower-loving Fly Surveys, June 2011.

INTRODUCTION

This protocol was modified from the U.S. Fish and Wildlife Service’s (USFWS) Interim General Survey Guidelines for the Delhi Sands Flower-loving Fly (Rhaphiomidas terminatus abdominalis, DSF) dated December 1996 which focuses on the goal of providing a credible method for determining DSF presence-absence at a given site. The Biological Monitoring Program DSF protocol used previously (2005 – 2010) consisted of a line-distance sampling methodology to estimate DSF density and detectability. Because gathering the data to calculate detection probabilities and annual abundance estimates requires significant personnel resources (in 2010 we conducted 67 site surveys across 39 days) and because DSF abundance at the only known occupied site in western Riverside County (Teledyne) appears to be stable or increasing, we postponed this more intensive study design in favor of a less time-consuming survey aimed specifically at meeting the species-specific objective of documenting successful DSF reproduction within conserved Core Areas in 2011.

The Western Riverside County Regional Conservation Authority (RCA) continues to acquire land set aside for conservation as part of the acquisition phase of the MSHCP. Because suitable habitat for this Endangered Species is extremely limited [recent estimates are that over 97% of the area containing Delhi series soils has been converted to uses unsuitable for DSF (USFWS 1996), any land acquired by the RCA in close proximity to Teledyne will be evaluated for suitable DSF habitat regardless of whether or not the land falls within an MSHCP-designated Core Area.

SURVEY GOALS:

A) Document successful reproduction of DSF within Core Areas, as measured by the presence/absence of newly emerged (teneral) individuals.

B) Document the habitat suitability of any newly acquired lands near conserved Core Areas.

To achieve the above goals, visual encounter surveys within suitable habitat will be conducted regularly during the DSF flight season in Core Areas accessible to the Monitoring Program. Data resulting from these surveys will be used to verify reproduction within Core Areas. On-site habitat suitability surveys will be conducted on lands in close proximity to known occupied locations as such lands are acquired.

TIMING:

Surveys for adult DSF will be conducted annually during the flight season, generally from July through September. The beginning of the survey season will occur in July, with the exact date depending on weather and available Monitoring Program.
personnel. Surveys will continue until all survey goals are met or DSF are no longer observable at locations known to be recently occupied.

**SURVEY LOCATIONS:**

Surveys to determine presence/absence and reproduction of DSF will be conducted annually in Core Areas accessible to the Monitoring Program. Surveys to determine whether suitable habitat exists on any newly acquired lands near conserved Core Areas will be conducted as soon as personnel are available after new lands are acquired and conserved. Accessible lands will be identified by the Project Lead prior to surveys.

In 2011, we will conduct DSF surveys in the Jurupa Hills Core Area (Teledyne site) and at a recently acquired property just east of Teledyne designated “Tax Sale 5”. The Teledyne site is located in the Jurupa Hills along the Riverside-San Bernardino County border in the vicinity of Pyrite Street. The site encompasses just over 6 ha of Delhi series soils and is primarily composed of coastal sage scrub vegetation. The Tax Sale 5 property is located just north of Highway 60 near the community of Sunnyslope, and covers roughly 52 ha of steep, hilly terrain along the western border of the Oak Quarry Golf Club. As of the 2011 DSF survey season, there is no existing conserved land in the Mira Loma or Agua Mansa Industrial Center Core Areas, therefore these locations are inaccessible to the Monitoring Program.

**METHODS:**

Before surveys begin, surveyors must demonstrate the ability to identify DSF and co-occurring insect families by passing the USFWS Delhi Sands Flower-loving Fly practical exam, and locating and identifying insects in the field with the Project Lead.

Suitable habitat at the Teledyne site has been previously mapped and is defined by the presence of Delhi series soils described in a GIS shapefile. After the survey season begins, pairs of observers will visit the site regularly (preferably twice a week if personnel are available). Surveys will be conducted between 1000 and 1400 hours. Weather conditions should be clear skies and winds < 5 mph. If wind speeds are sustained at > 5 mph, surveyors will delay beginning the survey until they decrease or cancel the survey if winds do not decrease. Infrequent gusts > 5 mph are acceptable. Surveys should not be conducted under cloudy, overcast, or rainy conditions (USFWS 1997).

Surveying consists of slowly walking within potentially suitable habitat looking for DSF either flying or perched on vegetation. **Move carefully to avoid trampling DSF adults, larvae or otherwise harming the habitat onsite.** Although DSF are likely to flush out of the way of a moving observer, it is imperative to avoid harming individuals because this Endangered Species is so rare. Walk slowly and stop occasionally to look around – surveyors standing still are more likely to see an insect already in flight.

Data collected when a DSF is encountered include: the coordinates of the original sighting location, time, sex, activity, whether or not the individual was teneral, and any
other relevant notes. Teneral individuals are “covered with golden pelage and have emerald green eyes and no rigid wing venation” (Kingsley 1996). If recording a DSF as teneral, take a digital photo when possible. Otherwise, take photos if time permits or you want to document the location of the fly. Binoculars are not required for surveying, but can aid in identifying behavior and age class of observed individuals.

When approaching a perched DSF for identification purposes, move slowly and keep the movement of your hands, arms, legs, and body to a minimum. If the fly is first seen in flight, follow from 1 – 2 m away until it lands, or you have seen enough to confirm that it is a DSF. Do not make sudden movements. If the fly is circling, stand still and wait for it to land – if it perceives your movement, it is less likely to stop. After the individual has been confirmed or disconfirmed as a DSF, and necessary data have been taken, return to the general departure point, and continue with the survey. Surveyors should also include DSF pupae cases (exuviae) in their search image while surveying as they are indicative of recent reproduction on site.

Digital photos taken as data (e.g., photos of teneral DSF or important behaviors) are stored as JPEG images at: S:\Projects\Data_Photos\DSF\2011 and are named according to the following convention: date photo was taken (yyymmdd), observer initials, JPEG number (e.g., “20100324_AJM_043”). Digital photos that are not official data associated with a given survey (e.g., general survey area photos, surveyors in the field) are stored at: S:\Projects\Invertebrates\DSF\Non-Data_Photos\Photos '11 and should follow the same naming convention. Note that it is critical that the exact name of each photo also appears on the appropriate datasheet.

The location coordinates of all DSF observed should be recorded with a GPS unit, whether they are observed before, during, or after a survey. If two or more DSF individuals are observed in the same small area (~10 m diameter circle) these can be recorded with the same waypoint, taken near the center of the cluster. Record the number of DSF observed on the datasheet. Data will be recorded in the NAD83 datum; all survey areas are in Zone 11S. Data should be entered into the Biological Monitoring Program database as soon as possible after collection and proofed following entry to ensure accuracy. UTM coordinates and additional data for any other MSHCP Covered Species encountered should be recorded on an Incidental Observation Form.

**Survey Equipment:**

- Handheld GPS unit
- Clipboard with data sheets and pen
- Thermometer
- Anemometer
- Digital camera
- Binoculars (if desired)
- Insect identification aids (if desired)

Determining whether suitable habitat is present consists of thoroughly searching properties in close proximity to known occupied locations for characteristic features of sites supporting DSF populations. The primary feature of interest is the presence of fine
sandy soils, generally classified as the Delhi series (USFWS 1997). Vegetation at suitable sites is typically sparse and often includes such species as *Eriogonum fasiculatum*, *Croton californicus*, and *Heterotheca grandiflora*. When these habitat features are present at a location in close proximity to known occupied locations, Monitoring Program biologists will map and digitize the suitable habitat and initiate presence/absence surveys for DSF as described above.

**Literature Cited:**

