

Western Riverside County MSHCP Biological Monitoring Program Delhi Sands Flower-loving Fly 2018 Survey Protocol

INTRODUCTION

The Western Riverside County Multiple Species Habitat Conservation Plan covers two insect species, one of which is the federally endangered Delhi sands flower-loving fly (Delhi fly, *Rhaphiomidas terminatus abdominalis*). The species is known to currently occur, or to have occurred in the past, within the following three Core Areas: Jurupa Hills, Agua Mansa Industrial Center, and Mira Loma (Dudek & Associates 2003). To date, conservation of the species within the Plan Area has only occurred within the Jurupa Hills Core Area (Teledyne site).

Goals and Objectives

1. Document successful reproduction of Delhi fly within Core Areas, as measured by the presence/absence of newly emerged (teneral) individuals.
2. Estimate Delhi fly density and detection probability using data collected along line-distance transects.
3. Gather data regarding Delhi fly resource selection and important distribution covariates including co-occurring insect Families within Core Areas.

METHODS

Survey Design

Following distance survey methodology, visual encounter surveys along pre-established transects will be conducted annually in Core Areas accessible to the Monitoring Program. Accessible lands will be identified by the Survey Lead prior to surveys. In 2018, we will survey the Teledyne site in the Jurupa Hills Core Area. Suitable habitat was previously defined by the presence of Delhi series soils (NRCS 2006). Results from pilot surveys in 2005 indicated that 32 parallel transects spaced approximately 15 m apart, and ranging from approximately 50 to 200 m long provided adequate coverage of the suitable habitat within the Jurupa Hills Core Area (see Biological Monitoring Program 2006). Transects established in 2018 will be the same transects used from 2005-2010, and 2014-2017. Surveys conducted 2011-2013 were reduced to a general site search to simply document successful reproduction.

We will divide the survey area into three sections (aggregate transect length range: 1,566-1,688 m) and survey each section once or twice a day depending on available personnel. Surveys for adult Delhi fly will be conducted for approximately ten weeks during the flight season, generally from mid-June through August. Annual surveys will not begin until adult Delhi fly have been observed on-site (e.g., via Scouting Surveys). Annual surveys will end when enough data has been collected to achieve the above goals, or after no Delhi fly are observed over four consecutive days.

Field Methods

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*, Delhi fly) dated December 1996. These USFWS guidelines were developed to

determine presence/absence of Delhi fly 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 observations, with the goal of estimating population density and detection probability following distance sampling methodology (Buckland et al. 2001). We have also modified the survey start date to mid-June to coincide with actual Delhi fly emergence at the Teledyne site.

Transect Setup

Transects will be marked with permanent fiberglass stakes approximately every 30 to 40 m and flagging will be placed on shrubs or grasses between stakes enabling observers to easily navigate the transect's centerline and accurately measure the perpendicular distance between any point on the transect and any Delhi fly observation. These points can be found at S:\Projects\Invertebrates\DSF\Transects\Fly Setup\2018\2018 Transect Points. During transect establishment, impenetrable vegetation stands (*e.g.*, *Prunus ilicifolia* or *Rhus trilobata*) that prohibit observers from walking directly on-transect will be marked with flagging on both sides of the stand. Observers will walk around these sections, and the impenetrable section of the transect will be excluded from the transect length measurements and subsequent analyses.

Surveying for Adult Delhi Fly

Scouting surveys (area search of the Teledyne site) will be conducted by a qualified observer twice per week beginning early-June until Delhi fly are observed on-site; confirmed Delhi fly emergence marks the start of annual data collection survey efforts. Data collection surveys will be conducted on established transects between 0930 and 1430 hours. When two observers are available on a given day, each observer will survey whole sections and start from opposite ends of the survey site, usually resulting in at least one section being surveyed twice in one day. When only one individual is available, the observer will survey as many whole sections as possible once. Weather conditions should be clear skies and winds less than 5 mph. If wind speeds are sustained at greater than 5 mph, observers will delay beginning the survey until they decrease or cancel the survey if winds do not decrease. Infrequent gusts over 5 mph are acceptable. Surveys should not be conducted under extremely cloudy, overcast, or rainy conditions since Delhi fly has not been observed under these conditions (USFWS 1997). Observers should actively scan the ground to enable detection of pupae cases (exuviae) of Delhi fly. If an exuviae is encountered it is to be recorded, a photograph of its location and surrounding vegetation will be obtained and then it will be collected to prevent repeated counts. Delhi fly observations made during a survey but while walking around an excluded section of a transect or when walking from one transect to the next are considered off the transect and these points are entered on the survey datasheet in the "DSF off transects and all Exuviae" section.

Any Delhi fly observed before or after an active survey are to be treated as Incidental observations; record coordinates and data for these observations and any other Covered Species on an Incidental Observation Form.

Field Procedure

1. Record date, section, observer(s) initials, time, temperature (°C) in shade 1 m above the ground, average wind speed (mph), general weather description using the USGS sky conditions codes (0 = clear or few clouds; 1 = partly cloudy; 2 =

- overcast; 3 = fog or smoke; 4 = light drizzle). These data are also recorded at hourly intervals and the end of each survey.
2. Navigate to the first transect within the section to be surveyed. On the datasheets, record Purpose and Method.
 - a. Purpose: whether the visit to the site is for the purpose of conducting a scouting survey or a data collection survey.
 - i. The Scouting Survey consists of the observer searching the area to determine if the Delhi fly has emerged.
 - ii. The Data Collection Survey consists of the observer conducting surveys in which they collect data on the Delhi fly.
 - b. Method: You will be assigned to conduct either a Line Distance Transect (LDT) survey or an Untimed Area Search (UAS).
 - i. LDT surveys involve walking pre-established transects while searching for the Delhi fly. This is typically done during Data Collection Surveys.
 - ii. UAS surveys involve determining presence/absence of Delhi fly while slowly traversing appropriate habitat.
 3. Walk slowly along the transect looking for Delhi fly either flying or perched on vegetation. Move carefully to avoid trampling Delhi fly adults, larvae, or otherwise harming the habitat.
 - a. Although Delhi fly 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 – observers standing still are more likely to see an insect already in flight.
 4. While walking a transect, always remain as close to the centerline of the transect as possible.
 - a. The statistics used to analyze the data collected assume that close to 100% of the Delhi fly that are directly on-transect are observed. Flies should take flight if an observer approaches them and a vigilant observer should notice a Delhi fly take flight in front of them nearly 100% of the time. Delhi fly occurring further off-transect will be observed with a decreasing probability as the distance from an observer on transect to the fly increases and this bias is accounted for in the statistical analysis.
 - b. If you come across a shrub that cannot be walked through but is low-lying such that it does not impede visibility of the transect (e.g., *Eriogonum fasciculatum*), continue to survey as you walk around the shrub.
 5. Upon observing a Delhi fly individual, mark the **original** location of the fly with a pin flag or flagged metal washer (i.e., where the fly was initially spotted) and then record the following data:
 - a. Transect number
 - b. Perpendicular distance from the transect centerline to the original sighting location (accurate to the nearest inch)

- i. Actively avoid rounding to noteworthy denominations (e.g., 0 inches, 12 inches, 50 inches). A fly seen two inches off the centerline should be recorded as such; likewise for 11 inches, or 51 inches). Pick the most accurate measurement spot you can, and stick with it.
- ii. The distance from the Delhi fly must be recorded as a line perpendicular to the transect line you were walking on (e.g., if the fly is detected to the west the bearing from the transect line to the fly location must be 298° , and if it is to the east the bearing must be 118° ; Figure 1).

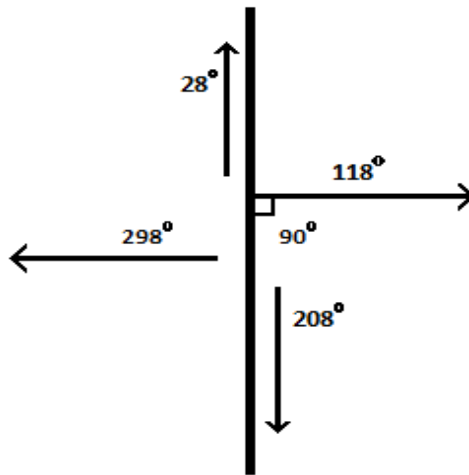


Figure 1.

- iii. If a Delhi fly is detected while you are navigating around a low-lying shrub you will measure and record the distance measurement from the transect centerline (i.e., not your location) to the Delhi fly (Figure 2).

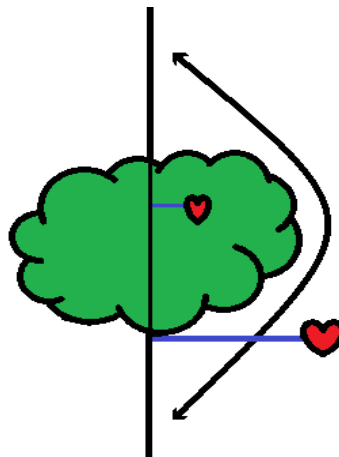


Figure 2.

- c. Coordinates of the original sighting
- d. Time

- e. Waypoint (sequential numbers are sufficient)
 - f. Sex
 - g. Activity (e.g., perched, cruising etc.)
 - h. Substrate
 - i. Age
 - i. Teneral individuals are “covered with golden pelage and have emerald green eyes and no rigid wing venation” (Kingsley 1996). If recording a Delhi fly as teneral, take a digital photo when possible. Otherwise, take photos if time permits or you want to document the location of the fly.
 - ii. Binoculars can aid in identifying behavior and age class of observed individuals.
 - j. Photo IDs
 - k. Relevant notes
6. When approaching a perched Delhi fly 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 at a distance of 1 – 2 m away until it lands, or you have seen enough to confirm that it is a Delhi fly. 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 Delhi fly, and necessary data have been taken, return to the transect departure point, and continue with the survey.
 7. Delhi fly observations made during a survey but while walking around an excluded section of a transect or when walking from one transect to the next are considered off the transect and these points are entered on the survey datasheet in the “DSF off transects and all Exuviae” section. Time, coordinates, sex, activity/behavior, substrate, age and photo IDs of these individuals should be recorded.
 - a. If two or more Delhi fly 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.
 8. If there are no observations of Delhi fly on a particular day, that information should be noted on the datasheet by writing “No DSF” in the notes section of the datasheet.
 9. Record the Families of co-occurring insect species encountered throughout the survey. Counts of co-occurring Families are unnecessary. If an insect is observed that you know is not Delhi fly, do not spend time attempting to identify the Family if it isn’t immediately apparent.
 10. Actively scan the ground to enable detection of pupae cases (exuviae) of Delhi fly.
 - a. If an exuviae is encountered, record the coordinates and time in the “DSF off transects and all Exuviae” section.

- i. After obtaining GPS coordinates, place your GPS unit next to the exuviae, step back 4-5 meters and take a photograph of the exuviae, making sure to include the surrounding vegetation.
 - ii. Collect the exuviae to prevent repeated counts.
11. Digital photos taken as data (e.g., photos of potentially teneral Delhi fly or important behaviors) are stored as JPEG images at:
S:\Projects\Data_Photos\DSF\2018 and are named according to the following convention: date photo was taken (yyyymmdd), observer initials, JPEG number (e.g., "20180724_TLG_211").
 - a. Digital photos that are not official data associated with a given survey (e.g., general survey area photos, observers in the field) are stored at:
S:\Projects\Invertebrates\DSF\Non-Data Photos\Photos '18 and should follow the same naming convention.
 - b. Note that it is critical that the exact name of each photo also appears on the appropriate datasheet.
12. Record incidental observation data and/or photographs of any other MSHCP Covered Species encountered. Record coordinates and data for Covered Species on an Incidental Observation Form.

Photo Stations

1. Photos will be taken in the four cardinal directions at three photo stations at Teledyne each year to qualitatively document the status of invasive plants and changes in community structure.
 - a. To ensure that these photos are as similar as possible from year to year, certain measures will be taken. The photos should be taken on, or as near as possible, to September 1st of each year around noon time.
 - b. Photographers will use a GPS to navigate to each photo station (photo station coordinates are located at: S:\Projects\Data_Photos\DSF\2018\DSF Photo Stations 2018). Once at the photo station, photos from previous years will be used as a reference to help the photographer take pictures that resemble previous years' photos as much as possible. To accomplish this, landmarks such as roads, ridgelines and shrubs should be matched and/or lined-up in a similar fashion as in previous years.
 - c. Photos will be taken 1 m from the ground using a camera with the standard 4:3 aspect ratio.

Equipment

- Handheld GPS unit
- Clipboard with data sheets and pen
- Kestrel
- 1 Pin flag or metal washer
- Compass
- Measuring tape
- Binoculars

TRAINING

Before surveys begin, observers must demonstrate the ability to identify Delhi fly and co-occurring insect Families by passing the USFWS Delhi Sands Flower-loving Fly practical exam. If an observer has passed the USFWS exam in a previous year, they must pass an in-house exam identifying insects, to family, set up by the Survey Lead. Study guides are located on the S drive at S:\Projects\Invertebrates\DSF\Study Guides.

DATA MANAGEMENT

The Survey Lead reviews survey objectives and ensures datasheets accurately reflect those objectives. The Lead also coordinates with the Data Manager to develop the database forms where data will be entered from the field datasheets. The Data Manager ensures that database forms are updated and ready for data entry.

Data entry follows the standard protocol established by the Monitoring Program. Data are entered into the database using a form created for each project. Because Biologists often participate in multiple surveys at any given time, data entry often occurs between other field responsibilities and as office time allows. One person enters data and a second person verifies the entries independently (i.e., quality assurance). Once completed, the Program Lead and Data Manager review the entries and correct errors (i.e. quality control). The Data Manager certifies the data once all errors had been corrected.

DATA ANALYSIS

Data resulting from these surveys will be used to verify reproduction within Core Areas and analyzed to provide insight into the ecology of Delhi fly. Additionally, we will use Program DISTANCE and measurements of the distance of a Delhi fly observation from the transect to estimate the detection probability and population density of Delhi fly (Buckland et al. 2001; Thomas et al. 2009).

TIMELINE

- Early June 2018: Establish survey transects; periodically visit the site to determine whether teneral flies have emerged. Hold a pre-survey training meeting and conduct co-occurring insect species exam.
- Mid-June- early July 2018 (dependent upon Delhi fly emergence): Begin Delhi fly surveys. Data will be entered concurrently with surveys.
- August 2018: Terminate surveys after four consecutive days of zero observations.
- Fall 2018: Data analysis and report writing.

LITERATURE CITED

- Biological Monitoring Program. 2006. Western Riverside County MSHCP Biological Monitoring Program 2005 Delhi Sands Flower-loving Fly Survey Report. Prepared for the Western Riverside County Multiple Species Habitat Conservation Plan. Riverside, CA. Available online: <http://wrc-rca.org/about-rca/monitoring/monitoring-surveys/>.
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2018 Delhi Sands Flower Loving Fly Survey

Date: _____ Section: _____ **Teledyne Site**

Observer(s) _____

Data Entered: _____

Data Proofed: _____

Purpose: Data Collection Survey _____ Scouting Survey _____

Method: Line Distant Transect _____ Untimed Area Search _____

* mph

** 0 = clear or few clouds; 1 = partly cloudy; 2 = overcast; 3 = fog or smoke; 4 = light drizzle

	Time	Temp °C	Avg Wind*	Weather**	Notes
Start :					
Hour 1:					
End :					

Age Code
 0: Pupa E : exuviae U: Unknown
 1: fuzz entirely covers dorsal thorax = teneral (note wing margin wear)
 2 : fuzz covers ≥ half dorsal thorax (note wing margin wear)
 3 : fuzz covers < half dorsal thorax (note wing margin wear)

Activities/Behaviors
Perched: indicate substrate
Interspecific Interaction: (different species) describe interaction
Intraspecific Interaction: (same species) describe interaction
Nectaring: record plant species, or take sample
Oviposition: *describe site, record soil temp!!! Tell lead right away.*
Emerging **Grooming** **Crusing**
Mating **Agonistic**

DSF on transects (During the survey start and end times AND on a transect.)

Transect #	Distance (in)	UTM East	UTM North	Time	Waypoint	♀ or ♂	Activity/Behavior	Substrate	Age	JPEG ID	Notes

DSF off transects and all Exuviae (All Exuviae and adult DSF during the survey start and end times but NOT on a transect.)

Time	UTM East	UTM North	♀ or ♂	Activity/Behavior	Substrate	Age	JPEG ID	Notes

Notes:

Insects or Insect Families Identified:

Coleoptera

<input type="checkbox"/>	Chrysomelidae – Cucumber Beetles
<input type="checkbox"/>	Coccinellidae – Ladybird Beetles
<input type="checkbox"/>	Curculionidae – Weevils
<input type="checkbox"/>	Meloidae – Blister Beetles
<input type="checkbox"/>	Rhipiphoridae – Wedge Beetles
<input type="checkbox"/>	Scarabaeidae – Scarab Beetles
<input type="checkbox"/>	Tenebrionidae – Darkling Beetles

Hemiptera

<input type="checkbox"/>	Cicadidae - Cicadas
<input type="checkbox"/>	Largidae - Bordered Plant Bug
<input type="checkbox"/>	Lygaeidae - Milkweed Bug
<input type="checkbox"/>	Pentatomidae - Stink Bug
<input type="checkbox"/>	Reduviidae - Assassin Bug
<input type="checkbox"/>	Scutelleridae - Jewel Bug

Lepidoptera

<input type="checkbox"/>	Hesperiidae – Skippers
<input type="checkbox"/>	Lycaenidae – Coppers, Hairstreaks and Blues
<input type="checkbox"/>	Noctuidae – Night Moth
<input type="checkbox"/>	Nymphalidae - Brushfooted Butterfly
<input type="checkbox"/>	Pieridae – Whites and Sulfurs
<input type="checkbox"/>	Pyralidae – Grain Moth
<input type="checkbox"/>	Sesiidae - Clearwing Moths

Diptera

<input type="checkbox"/>	Apioceridae – Flower Loving Fly
<input type="checkbox"/>	Asilidae – Robber Fly
<input type="checkbox"/>	Bombyliidae – Bee Fly
<input type="checkbox"/>	Calliphoridae – Blow Fly
<input type="checkbox"/>	Conopidae – Thick-headed Fly
<input type="checkbox"/>	Muscidae – House Fly
<input type="checkbox"/>	Mydidae - Mydas Fly
<input type="checkbox"/>	Sarcophagidae – Flesh Fly
<input type="checkbox"/>	Stratiomyidae – Soldier Fly
<input type="checkbox"/>	Syrphidae – Hover Fly
<input type="checkbox"/>	Tabanidae – Horse Fly
<input type="checkbox"/>	Tachinidae - Tachinid Fly
<input type="checkbox"/>	Tephritidae – Fruit Fly

Hymenoptera

<input type="checkbox"/>	Chrysididae – Cuckoo Wasp
<input type="checkbox"/>	Crabronidae - Sand Digger Wasp
<input type="checkbox"/>	Formicidae – Ants
<input type="checkbox"/>	Ichneumonidae - Ichneumon Wasps
<input type="checkbox"/>	Mutillidae – Velvet Ant
<input type="checkbox"/>	Pompilidae – Spider Wasps
<input type="checkbox"/>	Scoliidae - Scoliid Wasp
<input type="checkbox"/>	Sphecidae – Thread-waisted Wasps
<input type="checkbox"/>	Vespidae – Paper, Potter Wasp, Hornet

Odonata

<input type="checkbox"/>	Anisoptera – Dragonfly
<input type="checkbox"/>	Zygoptera – Damselfly

Orthoptera

<input type="checkbox"/>	Acrididae – Grasshoppers
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Mantodea

<input type="checkbox"/>	Mantidae – Mantises
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Bees

<input type="checkbox"/>	Apidae – Bumble Bees, Honey Bees
<input type="checkbox"/>	Halictidae – Sweat Bees
<input type="checkbox"/>	Megachilidae - Leaf Bees

Neuroptera

<input type="checkbox"/>	Chrysopidae – Lacewing
<input type="checkbox"/>	Myrmeleontidae – Ant lion

Other _____