

Western Riverside County MSHCP Biological Monitoring Program Arthropod 2018 Pilot Study 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*). To date, conservation of the species within the Plan Area has only occurred within the Jurupa Hills Core Area (Teledyne site); therefore, this site must be able to support a healthy population of the Delhi fly. We will collect data regarding the food resources of larval Delhi fly, a stage which may last two years or longer depending on availability of food, temperature, rainfall, and other environmental conditions (USFWS 1997). These data will be coupled with environmental data collected via an on-site HOBO weather station and vegetation surveys to infer the quality of the Delhi sand dunes at Teledyne (Hulton et al. 2013). This survey is designed to provide researchers with information that could be used to improve the Delhi fly's habitat and resource availability. By randomly placing arthropod pitfall traps across the site, we can collect more specific data on co-occurring arthropod species than the Delhi sands flower-loving fly surveys can provide alone in order to meet the goals and objectives listed below.

Goals and Objectives

1. Gather data regarding co-occurring arthropod species within Core Areas.
 - a. Use the data to track the relative abundance and richness of the arthropod community, which the predacious Delhi fly larvae presumably utilize as a food resource (*Ken Osborne, consultant, personal communication*).
 - b. Pair the arthropod data with the data from vegetation surveys to infer the habitat quality of the Delhi sand dunes at Teledyne over time (Hulton et al. 2013).

METHODS

Survey Design

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). We use ArcGIS to generate 50 random points covering the entire study area, no less than 10 meters from the edge of suitable Delhi fly emergence habitat, which will be used for the pitfall trap placements. Only half of the random points ($n = 25$) will be used during any given trap bout due to observer availability.

Surveys for adult ground-dwelling arthropods will be conducted two weeks per month until adult Delhi flies emerge. Surveys will begin in April when arthropod activity is at its peak and continue until observers detect an adult Delhi fly, generally around mid-June, at which point we will begin the Delhi fly surveys (Barrows 1997). The pitfall trap locations will be flagged, and the traps will be set out and opened in the afternoon on the first day of the week. Traps will be checked every morning for four consecutive days, and removed each morning once all captured insects have been recorded; a biologist will return each evening to reset the traps at the flagged locations. For our pilot year (2018), we will deploy pitfalls traps for two consecutive

nights during the month of May in order to assess the effectiveness of our methods and preliminarily determine the species composition of the insects captured on-site.

Field Methods

This protocol was modified from the *Coachella Valley Multiple Species Habitat Conservation Plan and Natural Community Conservation Plan (CVMSHCP) Aeolian Sand Communities and Species Monitoring Protocols (CVCC 2012)*. These CVMSHCP guidelines were developed to determine food resources, cover, sand conditions, species associations and food web linkages. We will be looking to determine food resources and sand dune conditions. If a Delhi fly is seen during the surveys or during pitfall setup, observers will record the time, coordinates, sex, activity/behavior, substrate (if applicable) and age on the datasheet, and report the sighting to the Survey Lead.

Pitfall Setup

Our pitfall traps will be made of clean one-liter bottles with the top portion removed and inverted to act as a funnel. Each trap will be covered with a small 8 inch by 8 inch fiberboard placed on three 1 inch legs to shade the captured arthropods from the sun. The pitfall traps will be placed at the random coordinates generated in ArcGIS and marked with labelled pin flags and flagging so they can easily be found by the different biologists conducting the surveys. If a biologist encounters conditions that inhibit the placement of the pitfall trap (e.g., concrete slabs, refuse) or impenetrable vegetation stands (e.g., *Prunus ilicifolia* or *Rhus trilobata*) that prohibit biologists getting to the exact point, the biologist will move the point to the southern side of the obstruction or shrub (at the drip line), respectively, and record the new coordinates.

Surveying for arthropods

The traps will be placed and opened starting at 1200 on the first day and will be left open overnight. Data collection surveys will be conducted at 0800 the following day until all 25 traps have been checked and removed. The traps will be reset starting at 1300 on days 2-4. In the morning on the final day (day 5) the traps will be checked and then removed. If available, two biologists will participate in each survey. If there is rain expected, the traps will be removed until rain is no longer in the forecast. Observers will scan the ground on their way to and from the pitfall traps to detect any arthropod species that may not have been collected in the traps and record them on the 2018 Arthropod Pitfall Trap Survey Species List datasheet.

Field Procedure

Setup (P.M. shift, day 1)

1. Observers will navigate to the first point and begin placing traps at approximately 1200. All points are saved on the server in both GPX and TOPO format (S:\Projects\Invertebrates\DSF\Arthropod\2018\Pitfall Points).
2. On the Arthropod Pitfall Trap Setup datasheet, observers will record:
 - a. The date and observers initials and their roles.
 - b. Time, soil temperature (°C), and 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 the end of each survey.
3. Observers will then install the pitfall trap with the following instructions:

- a. Using a hand shovel, start by digging a 1 foot deep hole and bury the one-liter bottle up to the edge. The substrate should be smoothed evenly around the bottle so that the edge is not visible. If a significant amount of substrate falls into the bottle during placement it should be scooped out before the funnel is placed.
- b. Place the funnel, inverted, into the bottle and make sure it is secure by applying slight downward pressure so that the funnel is nestled snugly within the bottle.
- c. Place the three wooden legs evenly around the trap then place the cover on the legs, over the opening of the trap to shade it from the sun, and weigh it down with the soil that was previously removed.
- d. Place a labeled pin flag, and flagging if necessary, near the trap so it can be easily found by other observers.
- e. Take a photo of the pitfall trap and the surrounding two meters and record the photo number.
- f. Record the top three vegetation species present within the surrounding two meters around the pitfall trap.

Survey (A.M. shift, days 2-5)

1. Observers will navigate to the first point, which is saved on the server in both GPX and TOPO format (S:\Projects\Invertebrates\DSF\Arthropod\2018\Pitfall Points).
2. Observers will scan the ground on their way to and from the pitfall traps to detect any arthropod species that may not have been collected in the traps and record them on the 2018 Arthropod Pitfall Trap Survey Species List datasheet.
3. On the Arthropod Pitfall Trap Survey datasheet, observers will record:
 - a. The date and observer(s) initials.
 - b. Time, soil temperature (°C), and 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 the end of each survey.
4. Observers will collect and record the species that have been trapped in the pitfall traps with the following instructions:
 - a. Remove the cover and the funnel, careful not to let any arthropods escape. Check the opening of the funnel for spiders that may have spun a web.
 - b. Remove the trap and transfer the arthropods to a pillow case by removing the entire trap and slowly sifting out the contents onto the pillow case, careful to keep an eye out for any “runners”.
 - c. Identify the captured arthropods to family, and if possible genus and species, then count and record how many of each species were captured in the trap.
 - d. After they have all been recorded, release the arthropods.
 - i. If there is any uncertainty as to the identity of an arthropod, photos will be taken or the arthropod can be brought back to the office for identification using an arthropod vial with a screen lid. Specimens will be released on-site the following day.

- e. Remove the trap before leaving the trap site.
 - i. Remove the entire trap from the ground and refill the hole with the soil that was previously removed. Leave the labeled pin flags and flagging to indicate trap location (days 2-4). Pin flags and flagging will be removed on the final day of surveys before leaving the trap site (day 5).

Opening traps (P.M. shift, days 2-4)

1. Observers will navigate to the first point, which is saved on the server in both GPX and TOPO format (S:\Projects\Invertebrates\DSF\Arthropod\2018\Pitfall Points).
2. On the Arthropod Pitfall Trap Setup datasheet, observers will record:
 - a. The date and their(s) initials.
 - b. Time, soil temperature (°C), and 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 the end of each survey.
3. Observers will then install the pitfall trap with the following instructions:
 - a. Using a hand shovel, start by digging a 1 foot deep hole and bury the one-liter bottle up to the edge. The substrate should be smoothed evenly around the bottle so that the edge is not visible. If a significant amount of substrate falls into the bottle during placement it should be scooped out before the funnel is placed.
 - b. Place the funnel, inverted, into the bottle and make sure it is secure by applying slight downward pressure so that the funnel is nestled snugly within the bottle.
 - c. Place the three wooden legs evenly around the trap, then place the cover on the legs, over the opening of the trap to shade it from the sun, and weigh it down with the soil that was previously removed.

Setup Equipment

- 30 pitfall traps
- 30 pitfall trap funnels
- 30 pin flags
- 30 trap covers
- 90 cover legs
- Clipboard with data sheets and pen
- Sharpie
- Handheld GPS unit
- Hand shovels
- Soil thermometer
- Kestrel

Survey Equipment

- Handheld GPS unit
- Clipboard with data sheets and pen
- Kestrel weather collector
- Arthropod guide
- Soil thermometer
- Gloves
- Sharpie
- 2 pillow cases/towels
- Arthropod vials
- Hand lens
- Hand shovels

TRAINING

Before surveys begin, observers who will be checking traps must demonstrate the ability to identify arthropod families by passing an in-house exam set up by the Survey Lead. Study guides are located on the server (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. One person enters data and a second person verifies the entries independently (i.e., quality assurance). Each person will record their initials on the bottom of the datasheet, in the space provided, to indicate they have completed their respective task. Once completed, the Survey Lead and Data Manager review the entries and correct errors (i.e., quality control). The Data Manager certifies the data once all errors have been corrected.

DATA ANALYSIS

Data resulting from these surveys will be used to infer the quality of the Delhi sand dunes at Teledyne and will be analyzed to provide insight into the ecology of Delhi fly.

TIMELINE FOR 2018 SURVEYS

- Early May 2018: Hold a pre-survey training meeting.
- Mid-May to late-May 2018: Conduct Arthropod surveys. Data will be entered concurrently with surveys.
- Fall 2018: Data analysis and report writing.

SUGGESTED FUTURE TIMELINE

- Early May: Hold a pre-survey training meeting.
- Mid-May to mid-June (dependent upon Delhi fly emergence): Begin Arthropod surveys. Data will be entered concurrently with surveys.
- Mid-June: Terminate surveys after Delhi fly emergence.
- Fall: Data analysis and report writing.

LITERATURE CITED

Barrows, CW. 1997. Habitat Relationships of the Coachella Valley Fringe-Toed Lizard, (*Uma inornata*). Southwestern Naturalist 42(2): 218-223.

CVCC [Coachella Valley Conservation Commission]. 2012. Aeolian Sand Communities and Species Monitoring Protocols. Coachella Valley Multiple Species Habitat Conservation Plan and Natural Community Conservation Plan, Palm Desert, CA. 33 pages.

Hulton VanTassel HL, Hansen AM, Barrows CW, Latif Q, Simon MW, Anderson KE. 2013. Declines in a ground-dwelling arthropod community during an invasion by Sahara mustard (*Brassica tournefortii*) in Aeolian sand habitats. *Biol Invasion* 16:1675-1687.

NRCS [Soil Survey Staff, Natural Resources Conservation Service (NRCS), United States Department of Agriculture (USDA)]. 2006. Soil Survey- Western Riverside Area (CA679)

USFWS [U.S. Fish and Wildlife Service]. 1997. Delhi Sands flower-loving fly (*Rhaphiomidas terminatus abdominalis*) Recovery Plan. U.S. Fish and Wildlife Service, Portland, OR. 51 pages.

2018 Arthropod Pitfall Trap Pilot Study Setup

Date: _____

Teledyne Site

Recorder _____ Photographer _____

** 0 = clear or few clouds; 1 = partly cloudy; 2 = overcast;

3 = fog or smoke; 4 = light drizzle

	Time	Soil Temp °C & Trap #	Weather
Start :			
End :			

Pitfall #	Top Veg Species 1	Top Veg Species 2	Top Veg Species 3	JPEG ID	Notes
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					

Delhi Flies seen outside of a pitfall trap

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

Data Entered: _____ Data Proofed: _____

2018 Arthropod Pitfall Trap Pilot Study Setup

Date: _____

Teledyne Site

Recorder _____ Photographer _____

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

	Time	Soil Temp °C and Trap #	Weather*
Start :			
End :			

Pitfall #	Top Veg Species 1	Top Veg Species 2	Top Veg Species 3	JPEG ID	Notes
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					
46					
47					
48					
49					
50					

Delhi Flies seen outside of a pitfall trap

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

Data Entered: _____ Data Proofed: _____

2018 Arthropod Pitfall Trap Survey Species List

Insects or Insect Families Identified:

Coleoptera

- Chrysomelidae – Cucumber Beetles
- Coccinellidae – Ladybird Beetles
- Curculionidae – Weevils
- Meloidae – Blister Beetles
- Rhipiphoridae – Wedge Beetles
- Scarabaeidae – Scarab Beetles
- Tenebrionidae – Darkling Beetles

Diptera

- Apioceridae – Flower Loving Fly
- Asilidae – Robber Fly
- Bombyliidae – Bee Fly
- Calliphoridae – Blow Fly
- Conopidae – Thick-headed Fly
- Muscidae – House Fly
- Mydidae - Mydas Fly
- Sarcophagidae – Flesh Fly
- Stratiomyidae – Soldier Fly
- Syrphidae – Hover Fly
- Tabanidae – Horse Fly
- Tachinidae - Tachinid Fly
- Tephritidae – Fruit Fly

Hemiptera

- Cicadidae - Cicadas
- Largidae - Bordered Plant Bug
- Lygaeidae - Milkweed Bug
- Pentatomidae - Stink Bug
- Reduviidae - Assassin Bug
- Scutelleridae - Jewel Bug

Hymenoptera

- Chrysididae – Cuckoo Wasp
- Crabronidae - Sand Digger Wasp
- Formicidae – Ants
- Ichneumonidae - Ichneumon Wasps
- Mutillidae – Velvet Ant
- Pompilidae – Spider Wasps
- Scoliidae - Scoliid Wasp
- Sphecidae – Thread-waisted Wasps
- Vespidae – Paper, Potter Wasp, Hornet

Bees

- Apidae – Bumble Bees, Honey Bees
- Halictidae – Sweat Bees
- Megachilidae - Leaf Bees

Lepidoptera

- Hesperidae – Skippers
- Lycaenidae – Coppers, Hairstreaks and Blues
- Noctuidae – Night Moth
- Nymphalidae - Brushfooted Butterfly
- Pieridae – Whites and Sulfurs
- Pyralidae – Grain Moth
- Sesiidae - Clearwing Moths

Odonata

- Anisoptera – Dragonfly
- Zygoptera – Damselfly

Orthoptera

- Acrididae – Grasshoppers

Mantodea

- Mantidae – Mantises

Neuroptera

- Chrysopidae – Lacewing
- Myrmeleontidae – Ant lion

Other _____