PLACER MOSQUITO & VECTOR CONTROL DISTRICT

Using small Unmanned Aerial Systems (sUAS) in an Integrated Vector Control Program in Placer County, California

May 8, 2019

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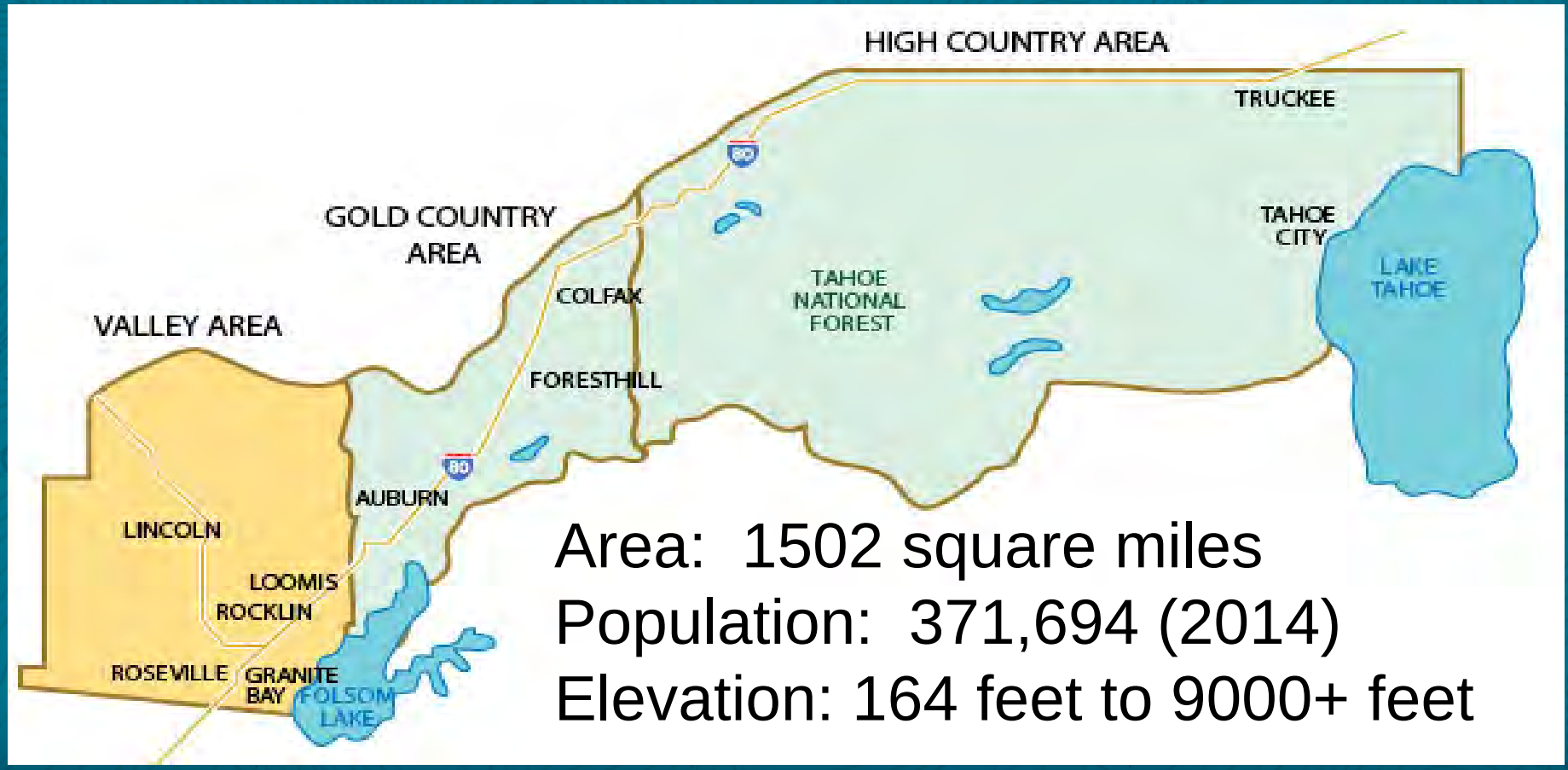
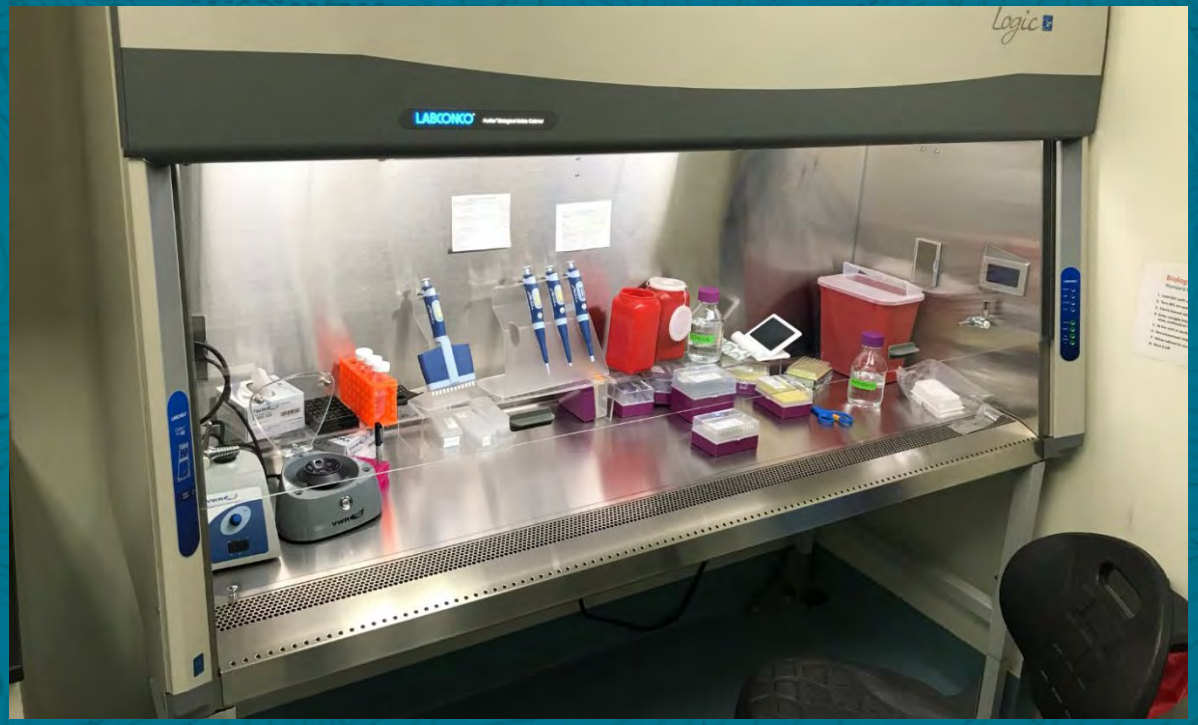
Placer Mosquito and Vector Control District



Area: 1502 square miles
Population: 371,694 (2014)
Elevation: 164 feet to 9000+ feet

Mosquito and Mosquito-borne Disease Surveillance



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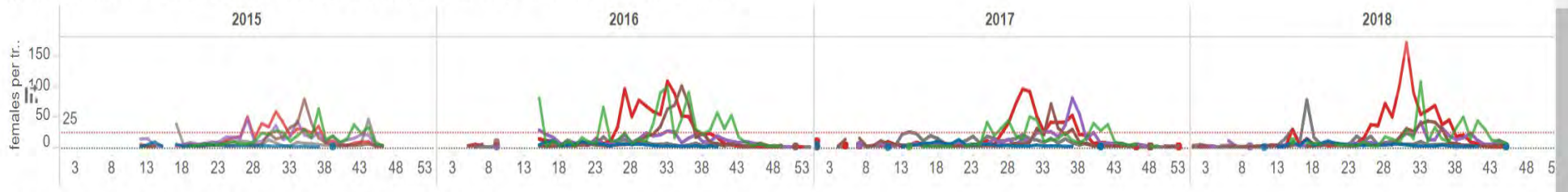
MOSQUITOES

CO2/EVS Traps - Weekly

Updated 11/7/2018 8:47:37 AM. *Includes all CO2 trap sites and species, unless specific ones selected from table below*



Moving Avg of Prior 3 Years vs Actual Count - Weekly

Updated 11/7/2018 8:47:37 AM. *Includes all CO2 trap sites and species, unless specific ones selected from table below*

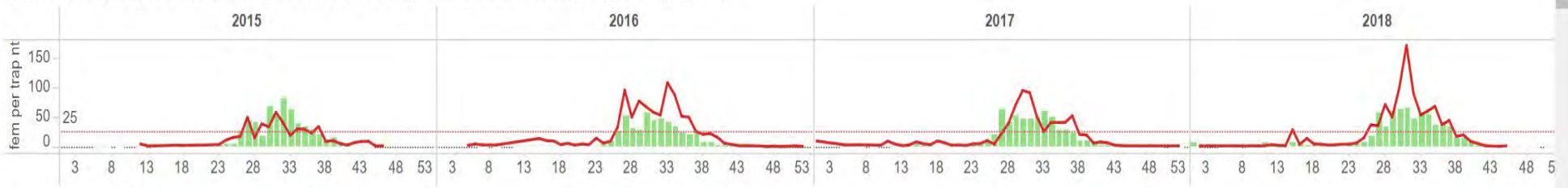
Select Species

(Multiple valu...

3 Yr Avg

Cx. tarsalis

(Blank Week)

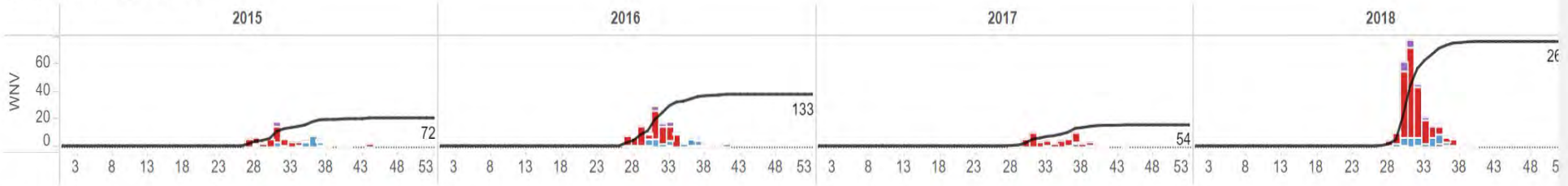


WNV Pools and Deadbirds - Weekly

Updated 11/7/2018 8:47:37 AM.

Bar - New cases that week

Line - Year to Date

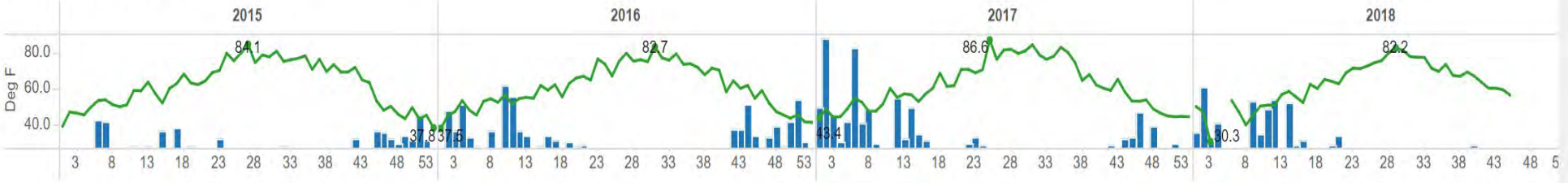


Lincoln Airport Weather - Weekly

Updated 11/7/2018 8:47:11 AM.

Avg Temp F

Precip In.



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Integrated Vector Management

IVM is a **science-based decision-making process** focused on protecting public health

IVM is achieved through:

- **Management of vector populations**
- **Interrupting the transmission of vector-borne pathogens**
- **Use of environmentally-sound methods**

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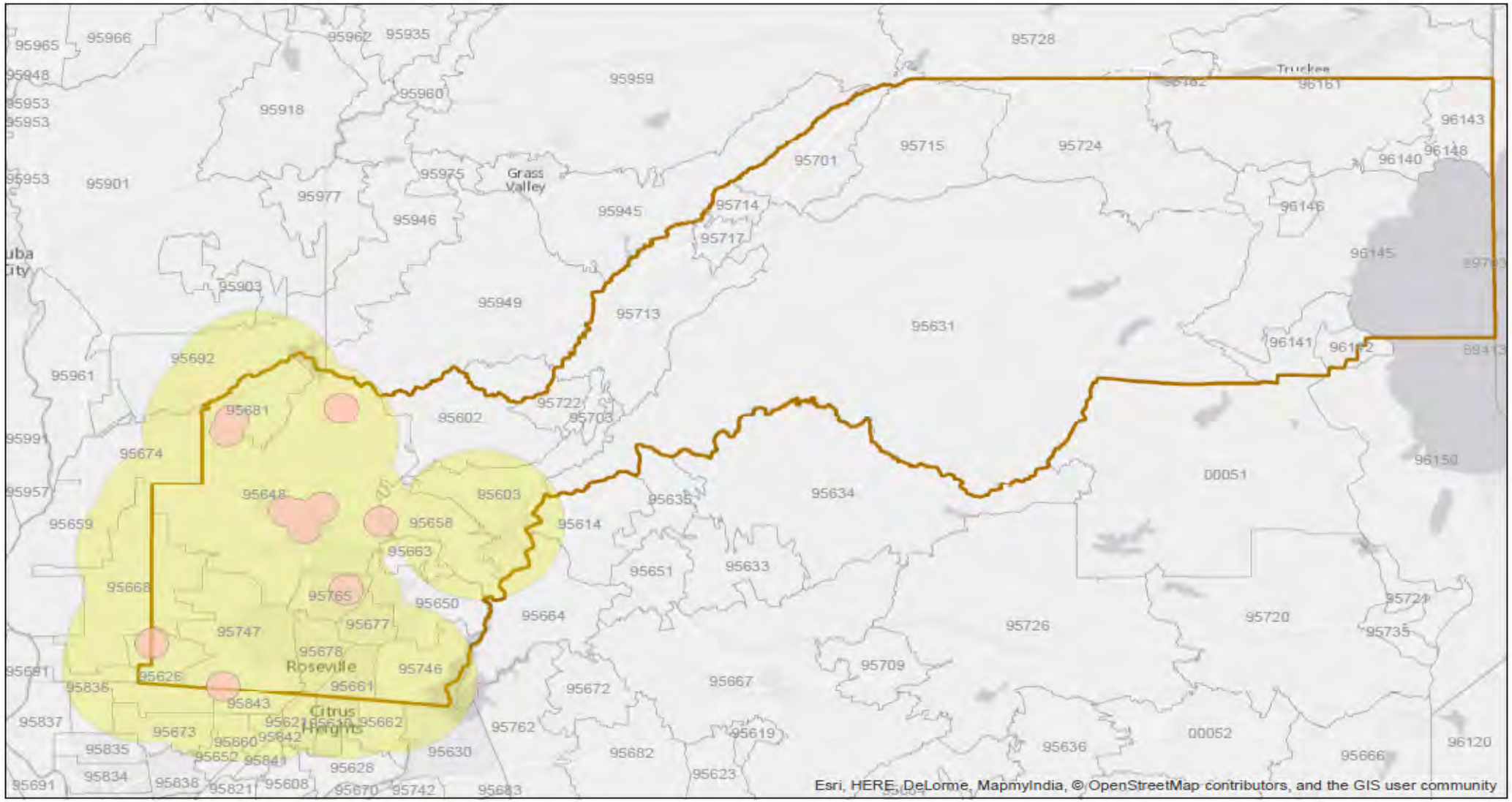
WNV RISK AREAS

WNV Risk Areas based on WNV+ Mosquito Samples (aggregate data from 2014 -2016

- 2014-2016 WNV positive Culex pipiens
- 2014-2016 WNV positive Culex tarsalis
- County_Boundary
- Placer_Region_ZIP_codes



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MOSQUITO CONTROL TOOL BOX

Prevents Mosquito Risk

- Physical Control
- Biological Control
- Larvicide
- General Outreach

Responds to Mosquito Risk

- Adulticide
- Barrier Treatments
- Targeted Outreach

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Mosquito Assessment and Control – UAS (MAC-UAS) Program

Phase 1: Training and Infrastructure

Phase 2: Basic Mission Development

Phase 3: Waivers and Advanced Missions

Phase 4: Larvicide Applications by sUAS

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UAS Mission Types

1. Atmospheric Measurements
2. Aerial Visual Monitoring
3. Remote Detection of Mosquito Habitat
4. Larval Detection
5. Larvicide Application
6. Adulticide Application

UAS Application Regulations

AVIATION – FAA

- Part 107 – Small UAS Rule
- Part 137 – Pesticide Application

- *Public Aircraft COA*
- *Part 333 Exemption*

PESTICIDE APPLICATION

- State Pesticide Applicator Certification
- State Aerial Application Certification
- Product Labels

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Mosquito Larviciding

- Purpose is to control larval mosquitoes to prevent future adult mosquito emergence.
- Can be very specific to mosquitoes and their close relatives
- Small amounts are applied directly to water in which mosquito larvae develop

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Agras MG1s Test Flight

[video]

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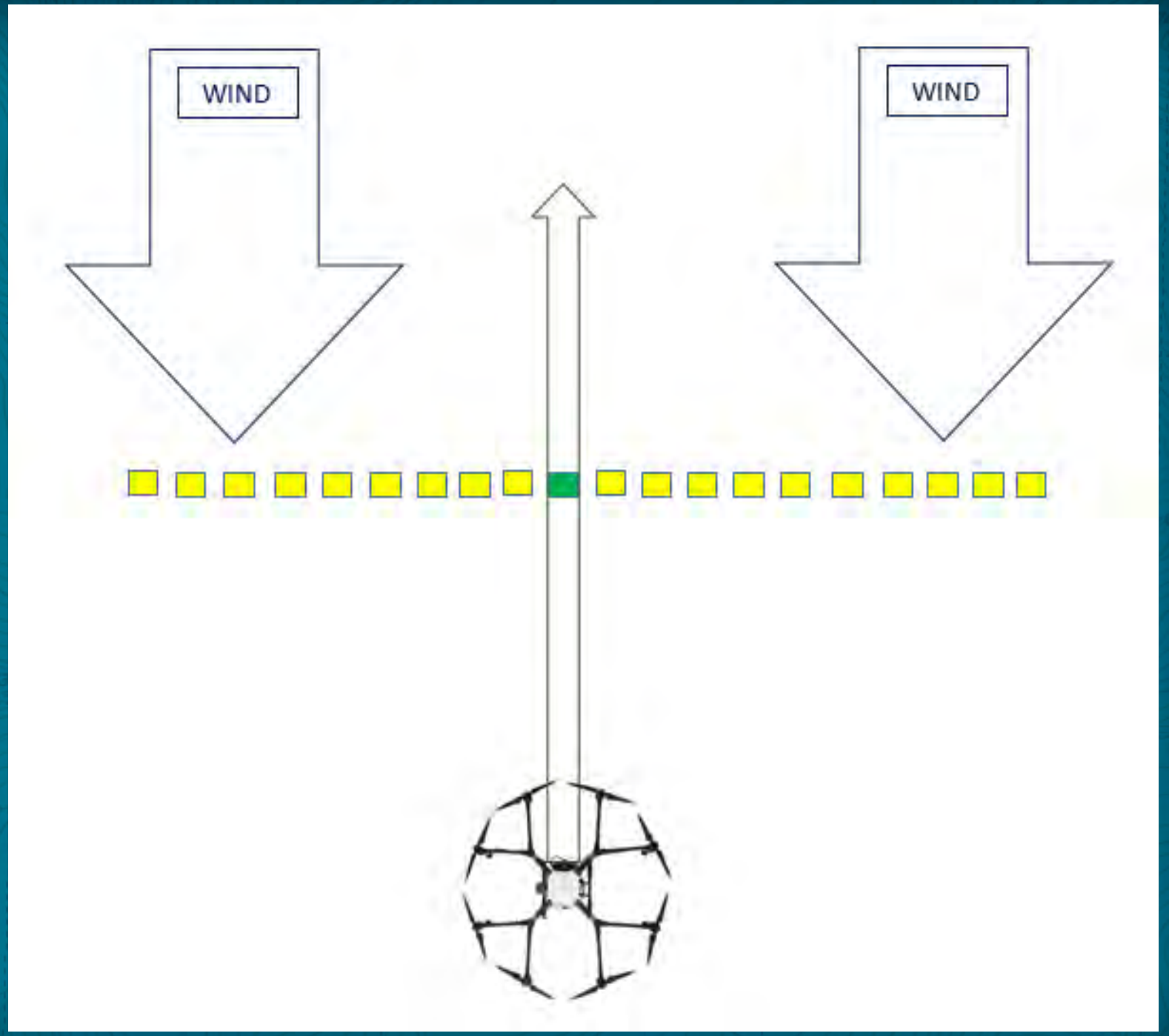
Swath Width/Droplet Characterization

1. Calibrate UAS to desired flow rate
2. Identify wind direction
3. Place a row of collection cards perpendicular to wind direction
   a. 1 or 2 feet apart from each other
   b. Place enough cards to capture entire swath width
4. Fly UAS over center card and directly into the wind
   a. Fly at application height and speed
   b. Three replicates are desired
5. Read Cards
   a. Droplet Size (DV 10, DV 50, DV90)
   b. Droplet Density



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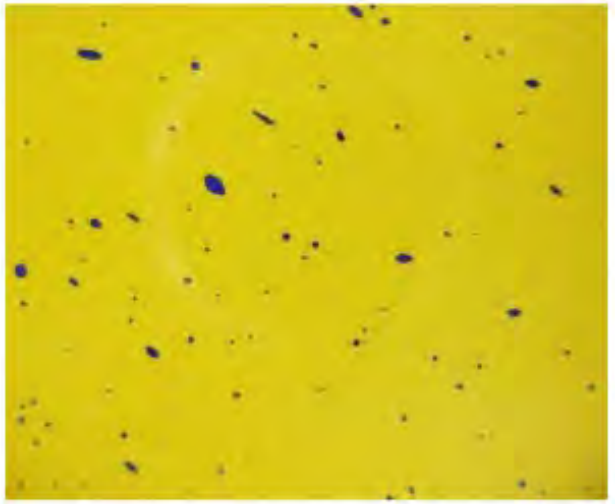
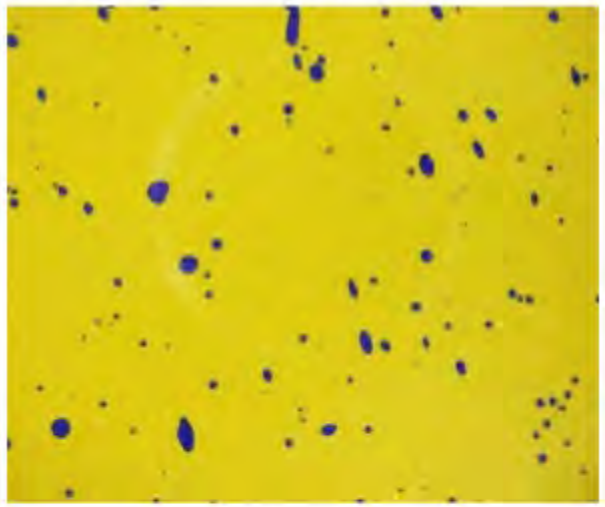
Droplet Characterization



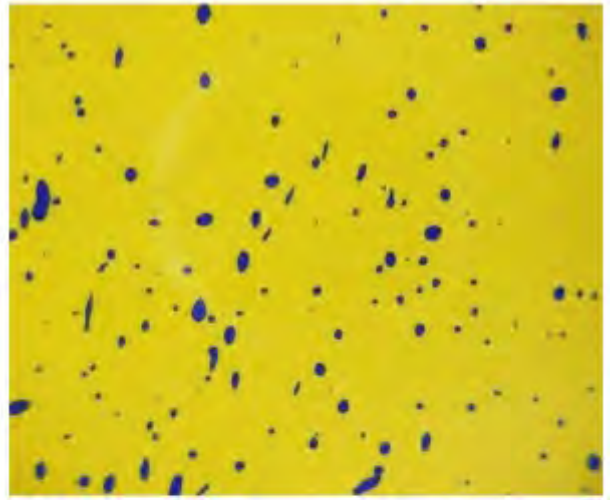
Droplet Density:33drops/c.. Volume Median Diameter (VMD) 179μm

Drop Coverage:0.79%	Sample Location:-0.5M
DV1:82μm	DV5:179μm
DV9:281μm	
50~100μm:60	100~150μm:9
150~200μm:11	200~250μm:2
250~300μm:1	300~350μm:0
350~400μm:0	>400μm:0



Droplet Density:42drops/c.. Volume Median Diameter (VMD) 245μm

Drop Coverage:2.39%	Sample Location:0.5M
DV1:128μm	DV5:245μm
DV9:464μm	
50~100μm:40	100~150μm:38
150~200μm:24	200~250μm:9
250~300μm:3	300~350μm:1
350~400μm:1	>400μm:1



Droplet Density:59drops/c.. Volume Median Diameter (VMD) 207μm

Drop Coverage:3.48%	Sample Location:1.0M
DV1:128μm	DV5:207μm
DV9:312μm	
50~100μm:52	100~150μm:54
150~200μm:36	200~250μm:17
250~300μm:3	300~350μm:3
350~400μm:0	>400μm:0

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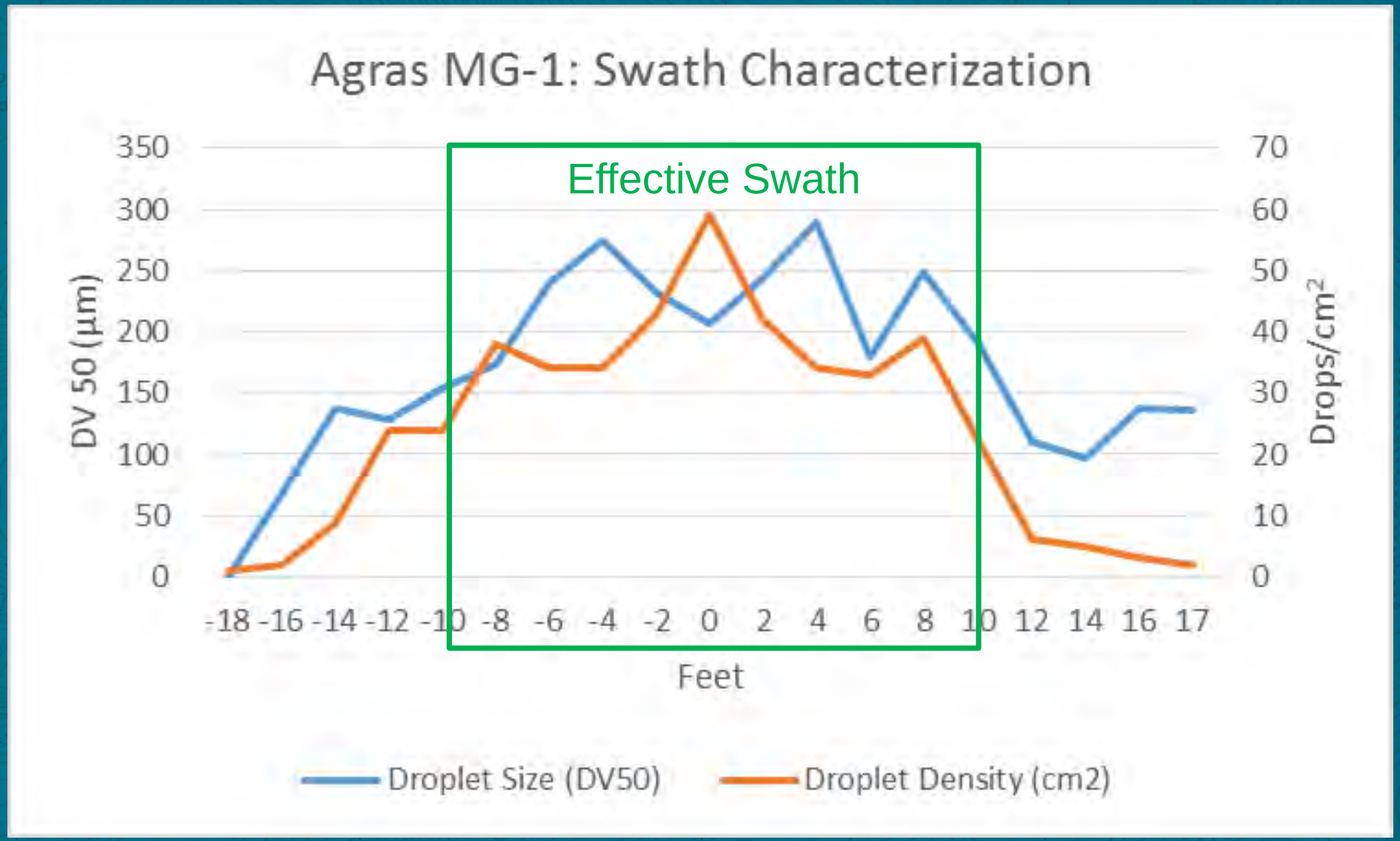

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Mosquito Adulticiding

- Purpose is to quickly reduce adult mosquito abundance to prevent biting and reduce risk of disease transmission
- Approved adulticides are applied to flying adult mosquitoes, typically as an ultra low volume aerosol cloud within a target area
- Timing of application with activity of mosquitoes is important for efficacy

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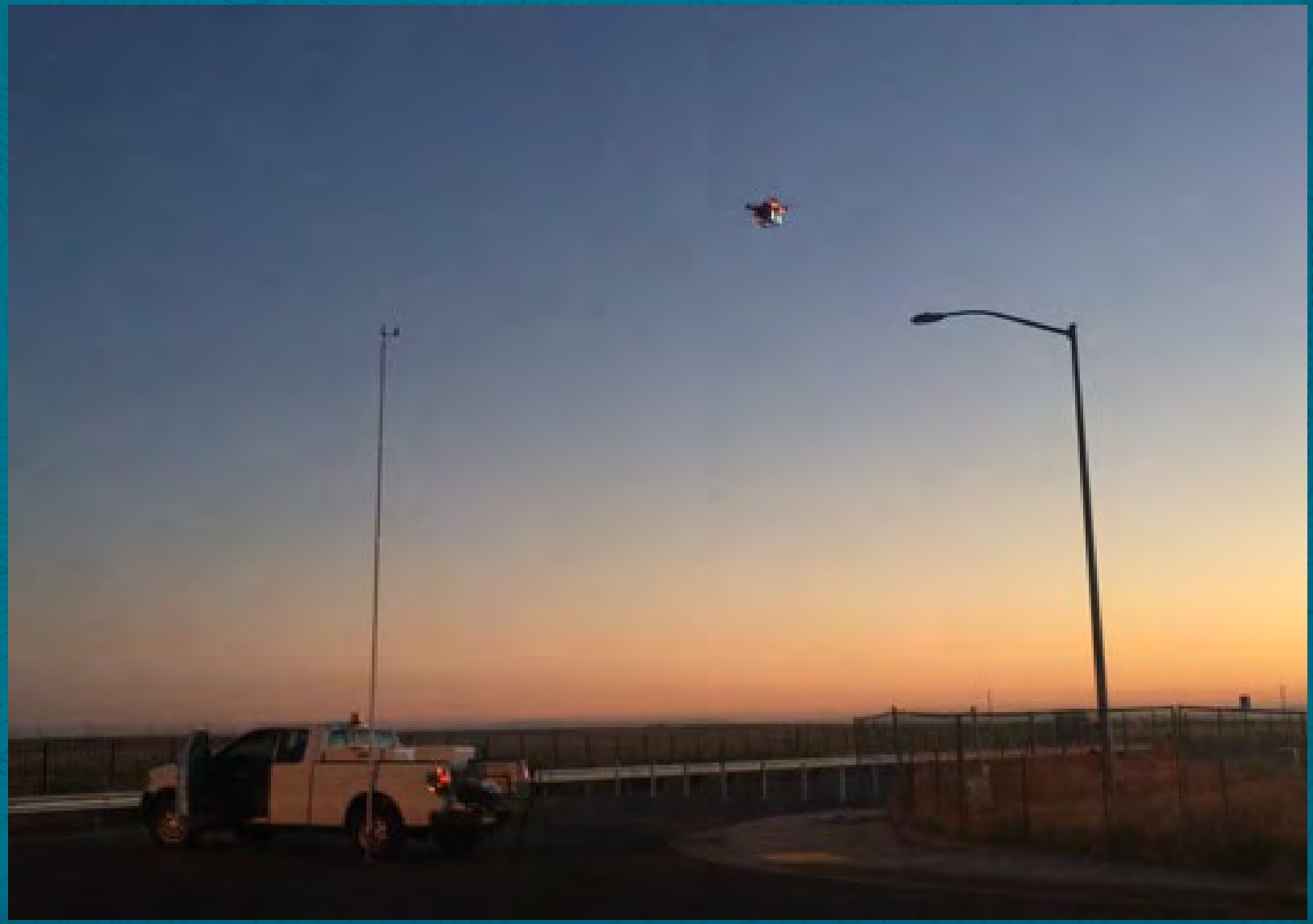
Atmospheric Conditions

Can we measure near ground temperature inversion to make go/no go decisions for aerial adulticide missions?

Can we use a UAS to detect temperature inversion in adulticide target area prior to deploying manned aircraft?



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Drone temperature data from afternoon, sunset, and sunrise tests 6/29-6/30.

Afternoon temperatures at the log decks show a clear non-inversion condition.

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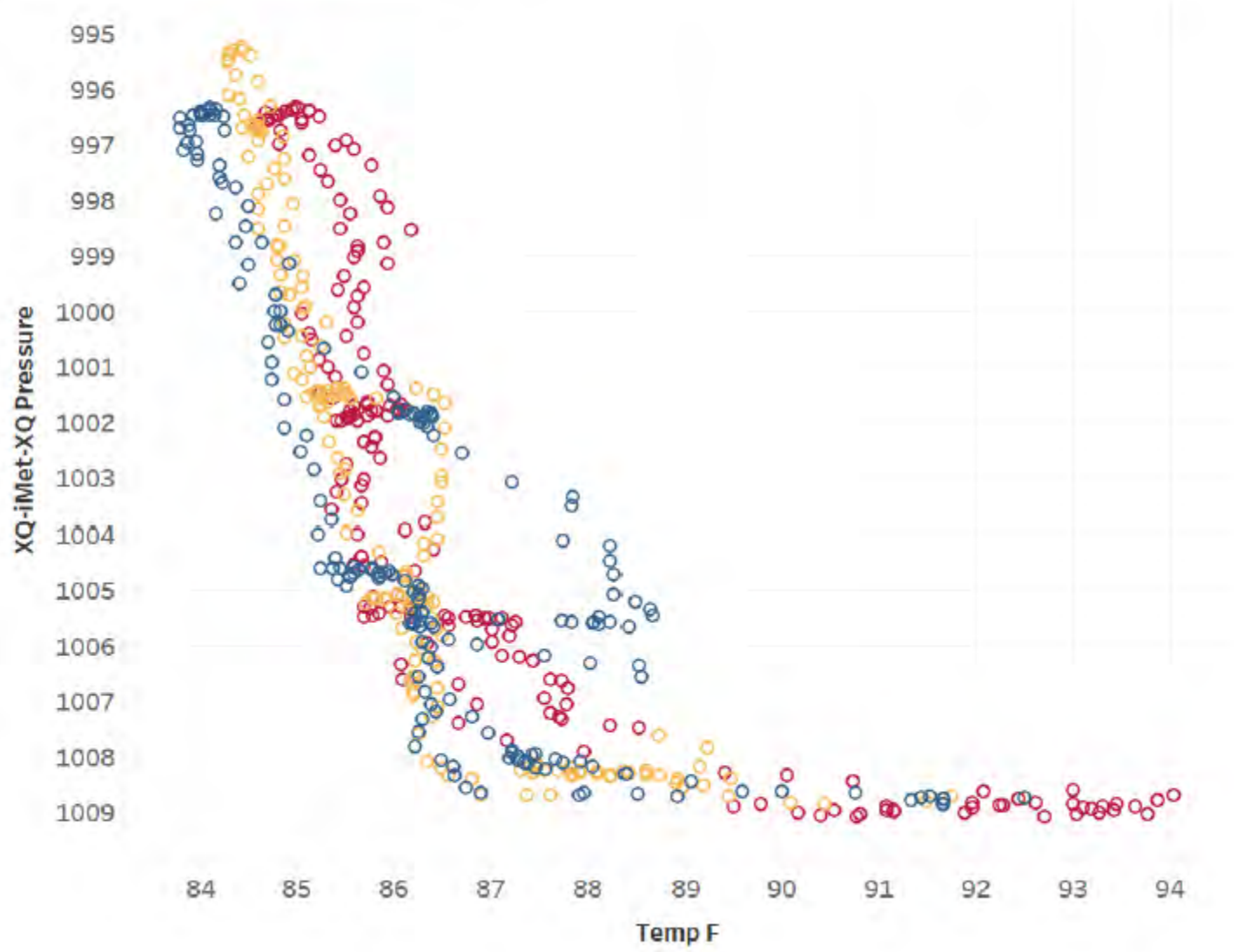

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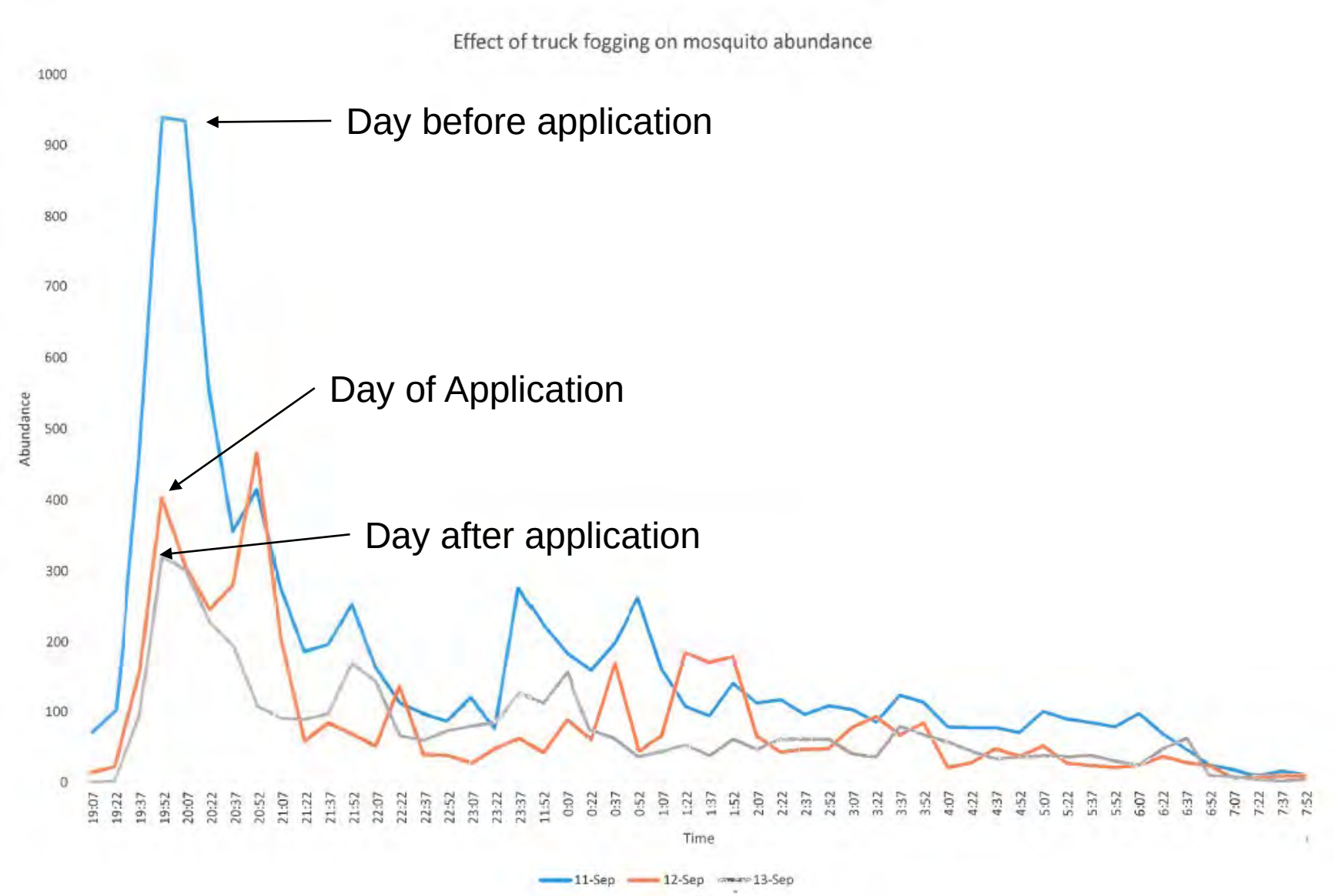
Truck ULV Adulticide Impact on Mosquito Activity



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Development Process for Unmanned Mosquito Control Applications

1. Emulate effective traditional (ground and manned aerial) applications and methods
2. Identify effective application capabilities for each UAS and associated application system.
3. Use UAS applications to manage mosquitoes at novel application sites, targeting precise life stages, conduct insecticide resistance management, and develop new methodologies for effective mosquito control.
4. Evaluate operations for efficacy and efficiency, make adjustments, and repeat.

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Closing thoughts

1. UAS applications have an important and emerging role in mosquito control programs
2. Complementary technologies to identify location and timing of mosquito control treatments can add value to UAS applications.
3. Mosquito larvicide and adulticide applications need mission specific UAS and sprayer combinations – one UAS will not do it all
4. Mosquito control product labels currently seem to be generally a good match for UAS applications
5. Need to be proactive to understand and address upcoming questions and challenges regarding UAS applications

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http://www.placermosquito.org/programs/technology-and-innovation/