Olive Fly Research Update

Corning 2008

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Contributing to olive fly research efforts in California are:

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Mary Bianchi, UCCE
Paul Vossen, UCCE
Joe Connell, UCCE
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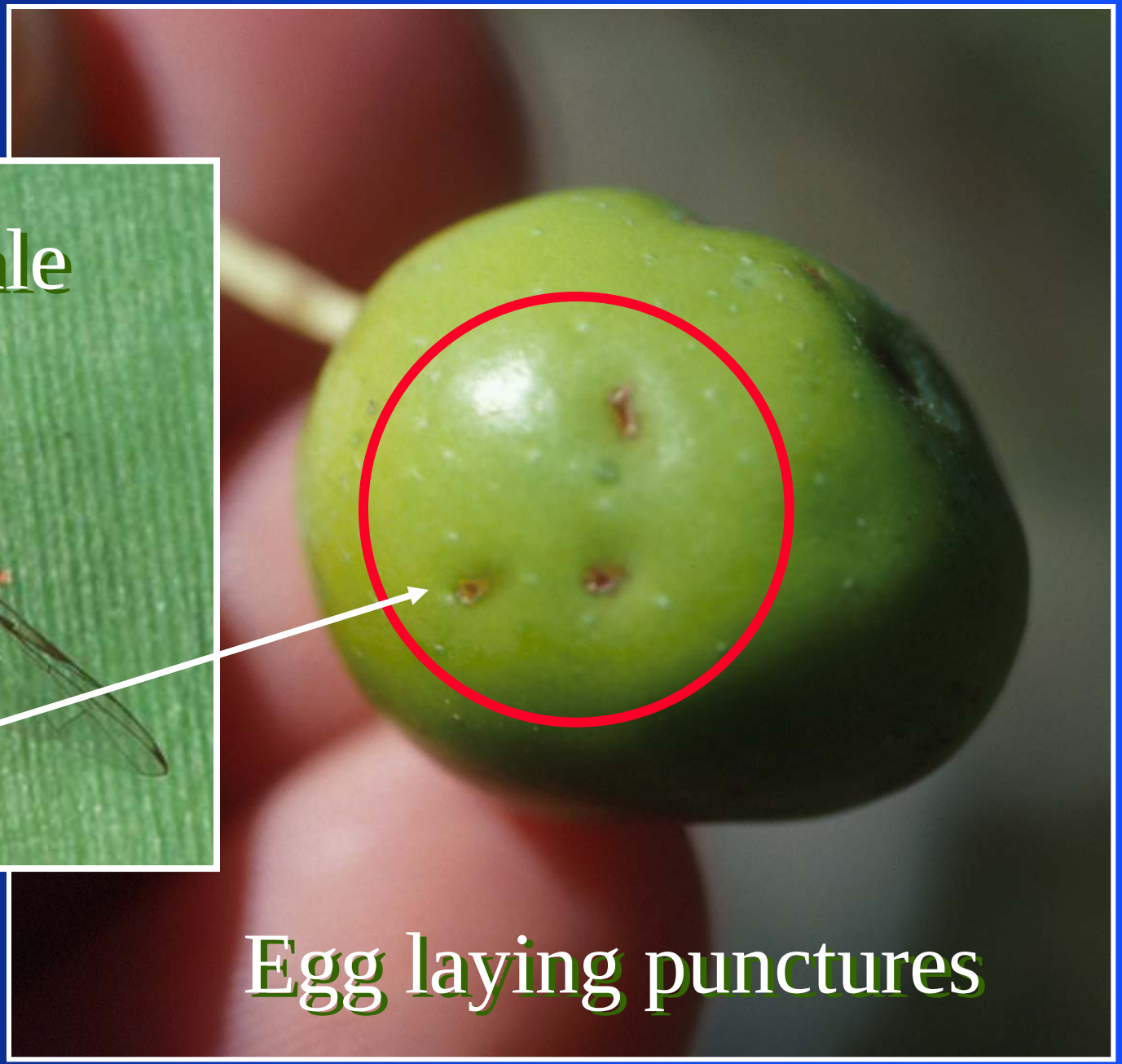
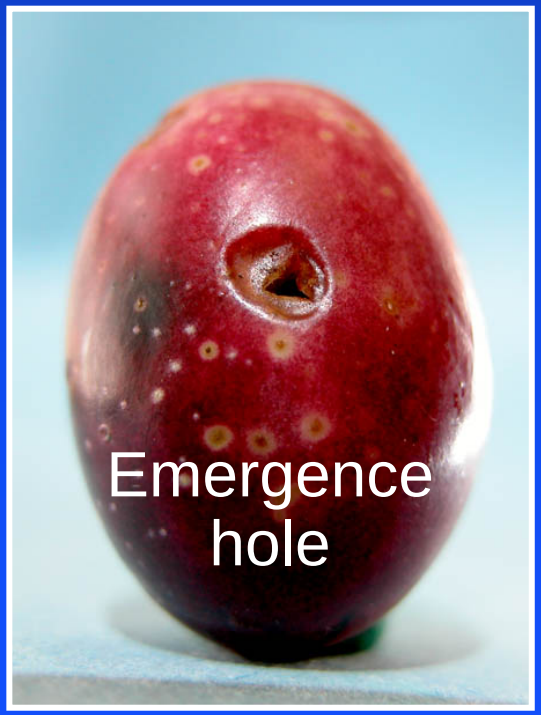
Vickie Yokoyama, USDA ARS
Joe Zermeno, CSU Hayward
Melanie Durbin, CSU Hayward


Adult female
Photo: R. Copeland


Egg laying punctures



Olive fly biology

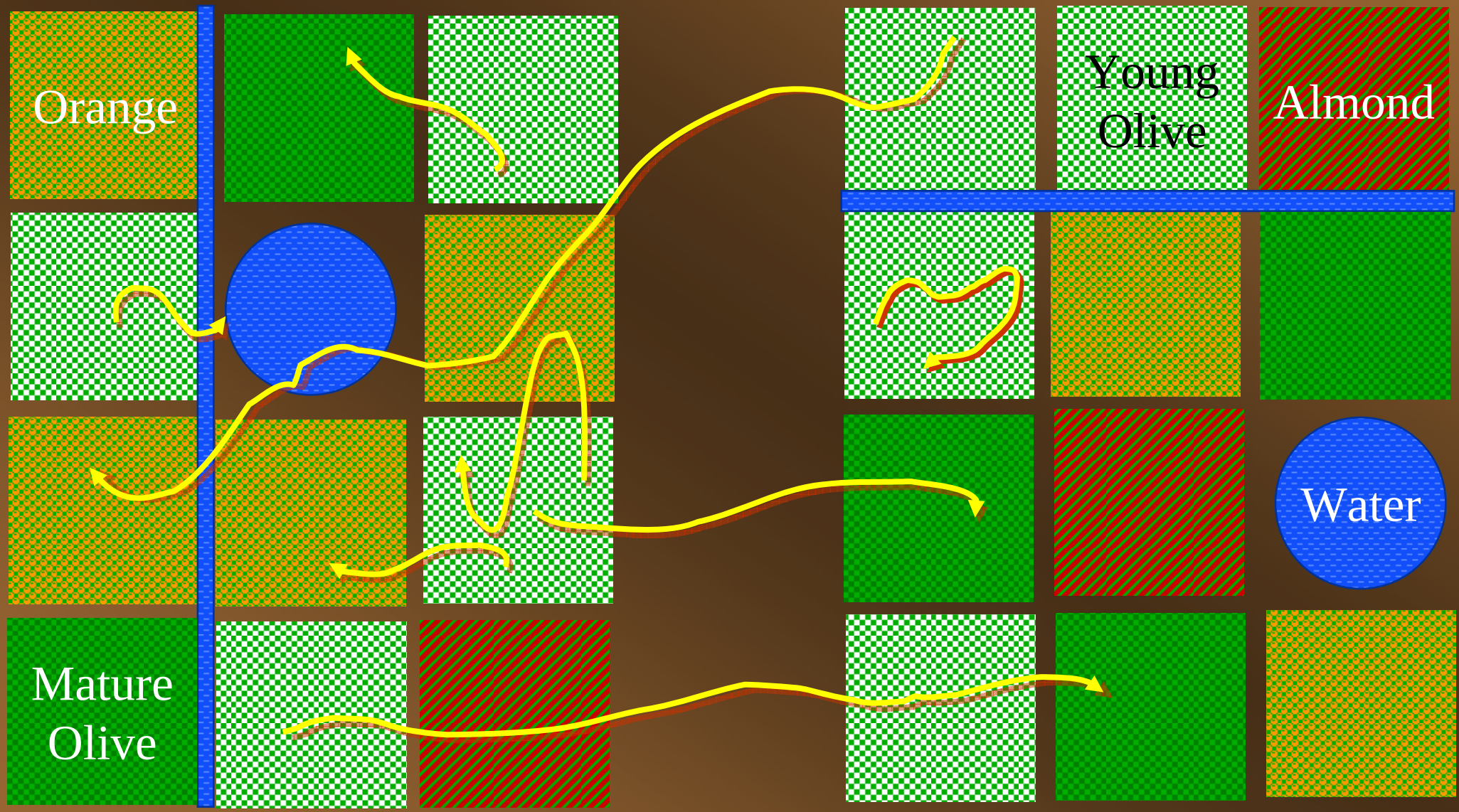

Buds and flowers


Green fruit


Ripe fruit


Fallen ripe fruit

Schematic of fly movements



Presentation Topics

- Timing and application of GF-120
- Current management alternatives
- Impact of summer heat on fly numbers
- The need to control black scale
- Biological control efforts underway


Application of Bait Spray
GF-120 NF Naturalyte Fruit Fly Bait
Approved for organic use

Application of Bait Spray

- Aerial applications not recommended
- Use alternate row coverage
- Treat north or east sides of trees

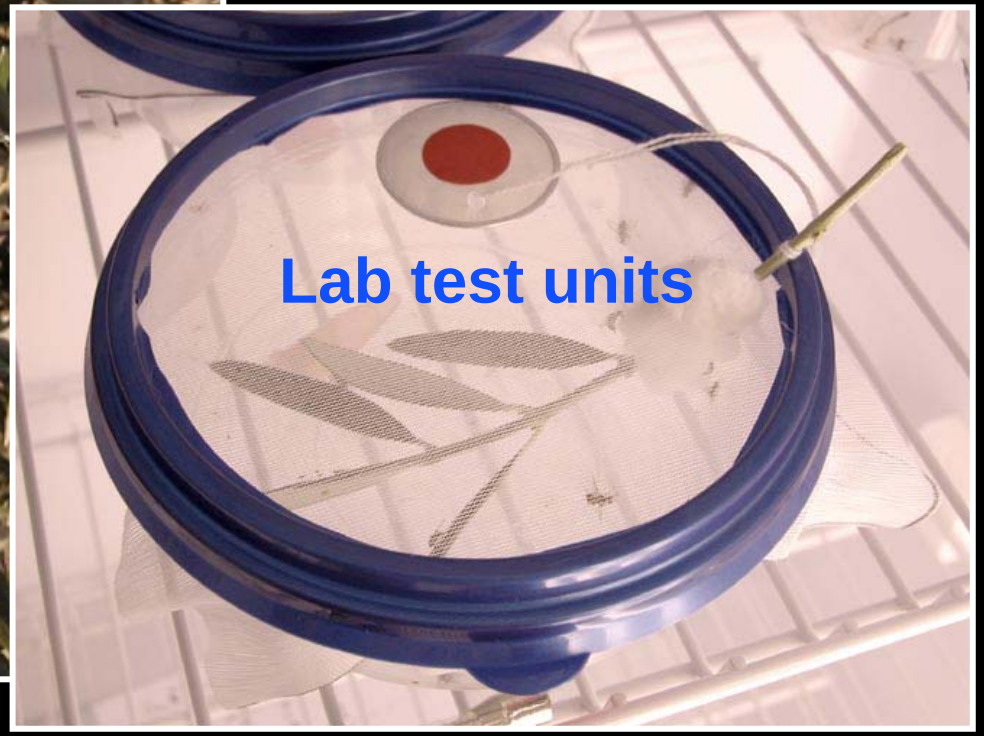
- Direct spray into upper half of tree
- For low OLF numbers use dilutions from 1: 1.5 to 1: 4 parts GF-120 to water
- 4 - 5 mm droplets are best

GF-120 Residue Longevity Studies

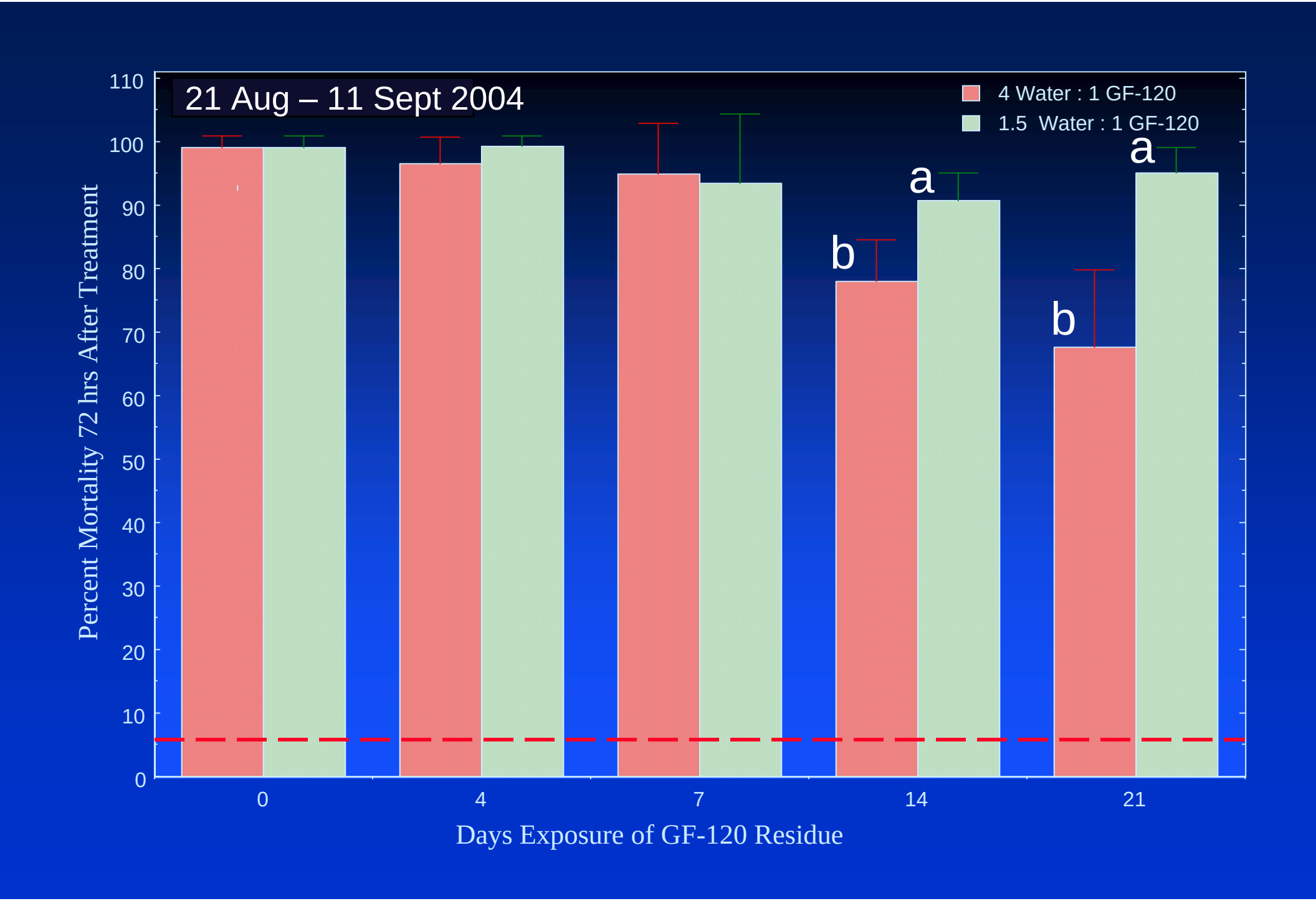
Bait droplets on leaf

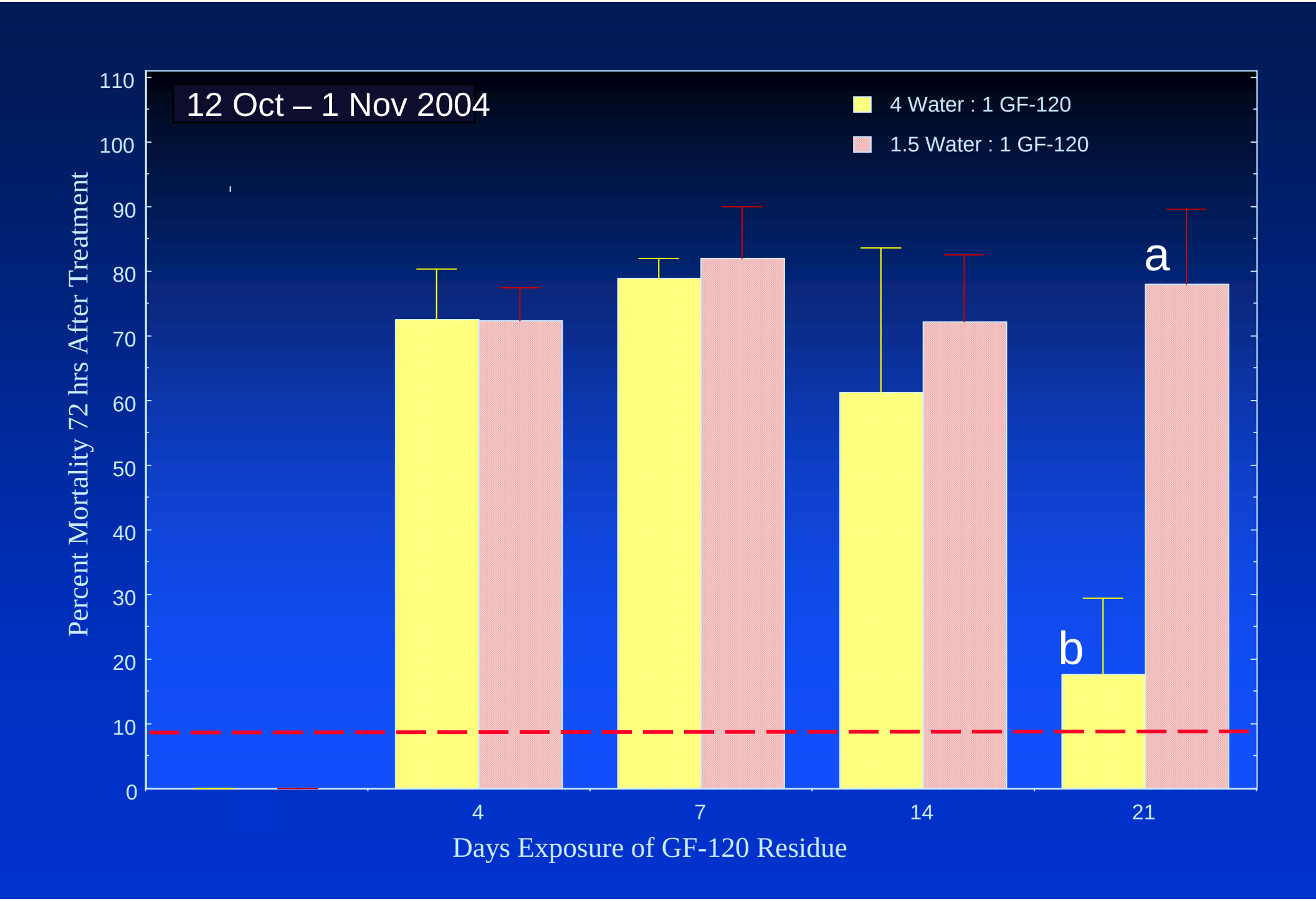
Tags indicating field exposure periods

Flies were exposed to aged residues for 4 hours & then held 72 hours to record mortality



Lab test units


21 Aug – 11 Sept 2004
4 Water : 1 GF-120
1.5 Water : 1 GF-120
Percent Mortality 72 hrs After Treatment
Days Exposure of GF-120 Residue
0
10
20
30
40
50
60
70
80
90
100
110
0
4
7
14
21
b
a
b
a


12 Oct – 1 Nov 2004
4 Water : 1 GF-120
1.5 Water : 1 GF-120
Percent Mortality 72 hrs After Treatment
110
100
90
80
70
60
50
40
30
20
10
0
a
b
4
7
14
21
Days Exposure of GF-120 Residue

What about high numbers of Olive Fly?

- No registered insecticide gives quick knock-down against high numbers of olive fly adults
- Use of the “recommended” rates of GF-120 under conditions with high olive fly numbers results in depletion of the GF-120 residues before all the flies are killed.
- To knock down high olive fly populations, use a dilution of 1 part GF-120 to 9 parts water and apply the recommended rate (14 fluid oz) per acre (R. Van Steenwyk). Even though less active ingredient is present in the droplet residues, it is enough to kill olive fly adults that feed on it.
- Once the olive fly population is knocked down (after 1 to 2 treatments), then drop the application rate back to the lower rates (1:1.5; 1:4).
- Presently, the product Danitol® (fenpropathrin) in combination with a fruit fly attractant (Nulure) has been submitted to the IR-4 program for registration for olive fly control. However, registration is probably a few years away.

Timing and Use of Bait Sprays

As recommended by the Olive Advisory Group / 2006

- Control of olive fly is essential because of the near-zero tolerance level established by table olive processors
- When fruit will be pressed for oil, the damage levels can be greater than in table olives, but best to keep fruit infestations below 10%
- A safe guideline is to initiate treatments near June 1 or two weeks before olive pit hardening
- If spring conditions are warm, a couple of earley sprays may be warranted in March or April to knock down the population. If populations are high, use a dilution ratio of 1 part GF-120 to 9 parts water to bring high populations down.
- GF-120 is the only sprayable bait legally available for use
- It cannot be applied more than once every 7 days
- Use rates vary from 10 oz. to 20 oz. active ingredient per acre
- 14 oz. a.i. per acre is currently being recommended

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Management Alternatives

- *Mass Trapping / Attract & Kill Traps.* No commercially available product is available. A homemade trap (OLIPE) may be employed, but is not recommended for large plantings and sites with high olive fly populations.
- *Post-harvest Sanitation.* Remove remaining fruit on trees from last harvest and destroy them on the ground by mulching or disking. Fruit must be buried at least 4 inches deep. Remove fruit from trees at least ½ mile from the orchard. High densities of olive fly in nearby orchards will overcome the benefits of post-harvest sanitation.
- *Soil Cultivation.* Many olive flies overwinter as pupae in the soil. Cultivation before the main spring and late summer flights can reduce fruit fly stings. Must disk 4 inches deep to have maximum effect.
- *Kaolin clay.* Protective barrier film (Surround WP®) made of highly refined Kaolin clay. Changes insects preference to lay eggs. More work is needed for practical application of method.

OLIPE

Olive Fruit Fly Trap from Spain

1.5 to 2.0 liter plastic bottle. Fill $^{2}/_{3}$ full with a 3-5% (30-50 grams per liter) solution of di-ammonium phosphate or ammonium bicarbonate and water. Sometimes vinegar and protein hydrolysate bait is also added

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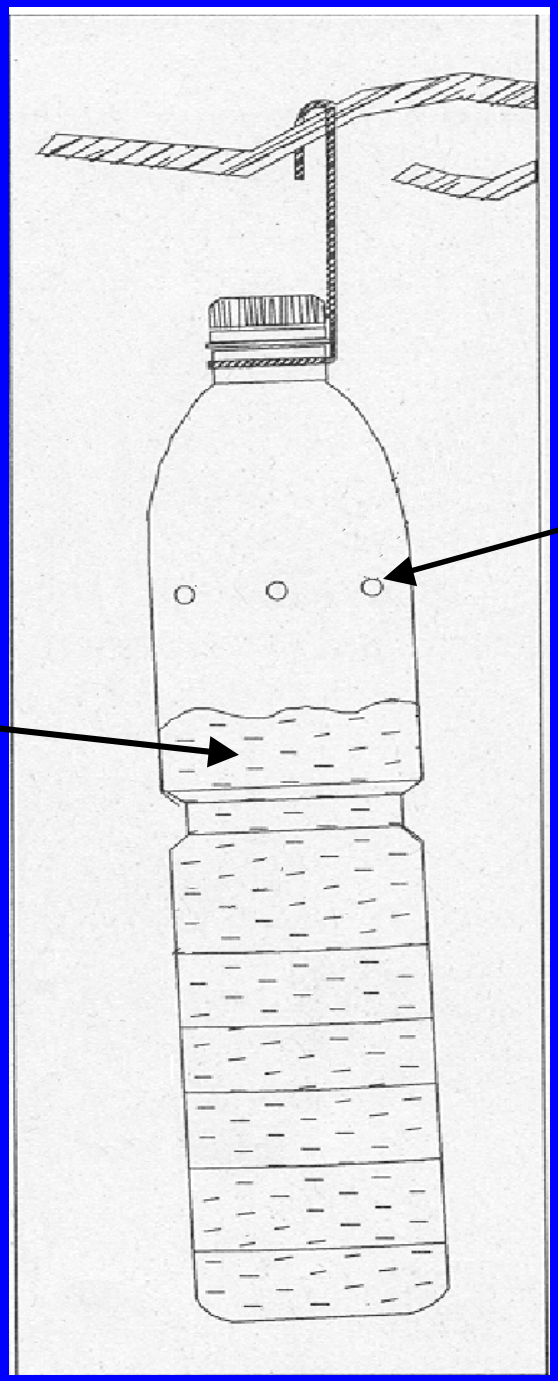
If stings exceed 3% - one mg of microencapsulated liquid spiroketal pheromone is added



Hang in the inside of the south side of the tree in the shade

Three to six 4-5mm ($^{3}/_{16}$ – ¼ inch) holes drilled or melted into neck

June – Sept.
8-10 traps/acre

Sept. – Dec.
16-20 traps/acre

From *Varela & Vossen 2002*

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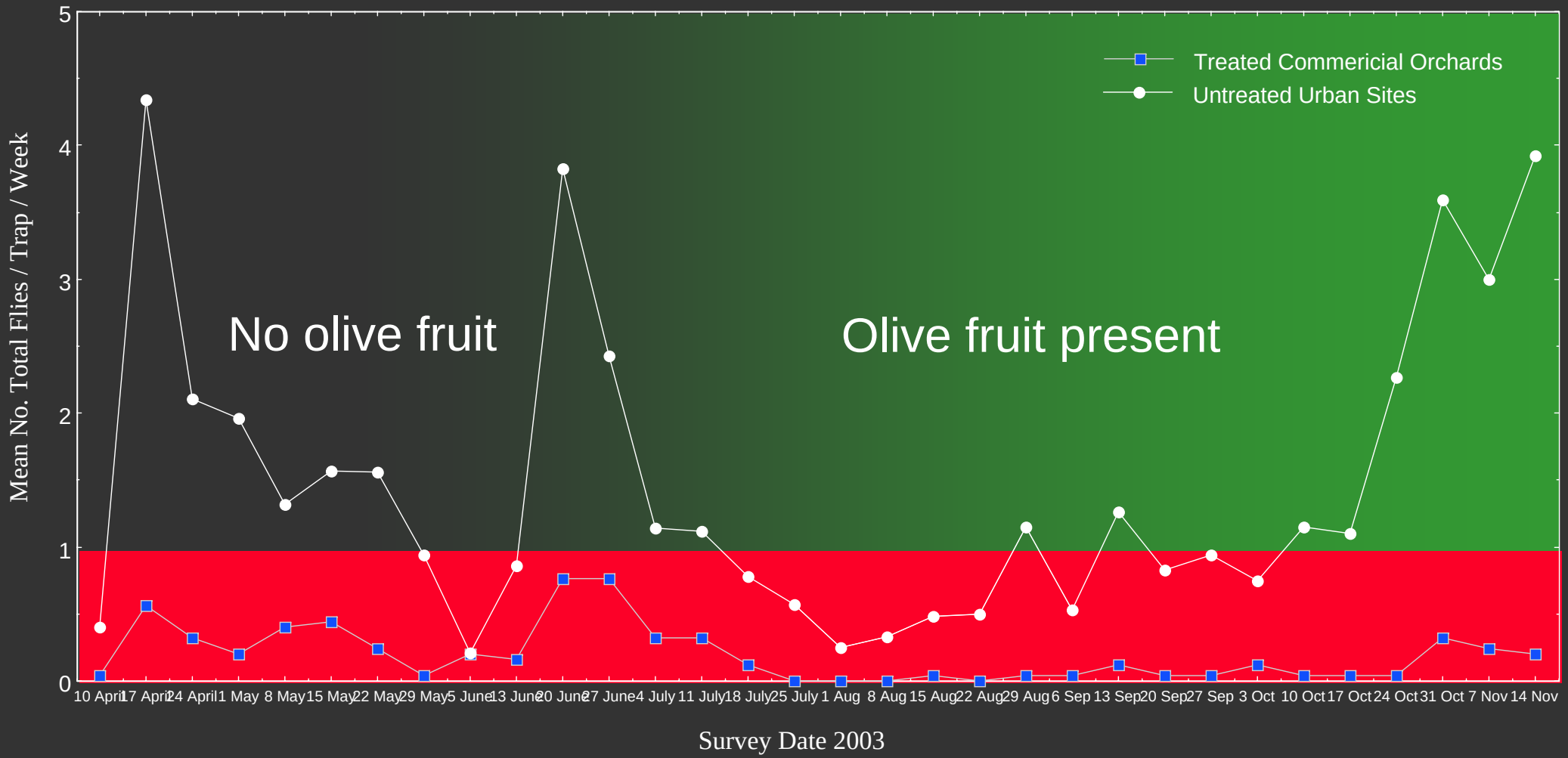
Some factors that potentially influence the impact of summer temperatures on olive fly

- Intensity of daily maximum temperature*
- Duration of daily highs (e.g., > 100°F for 4 days)*
- Relative humidity*
- Olive fly's access to water (availability of irrigation sources, morning dew, ponds, creeks, etc.)
- Olive fly's access to a carbohydrate source (e.g., honeydew)
- Olive fly's ability to seek refuge from the heat by dispersal
- Stage of insect (egg, larva, adult)

* Highly dependent on location in state

Average Adult Olive Fly Trap Counts in Tulare & Fresno Counties



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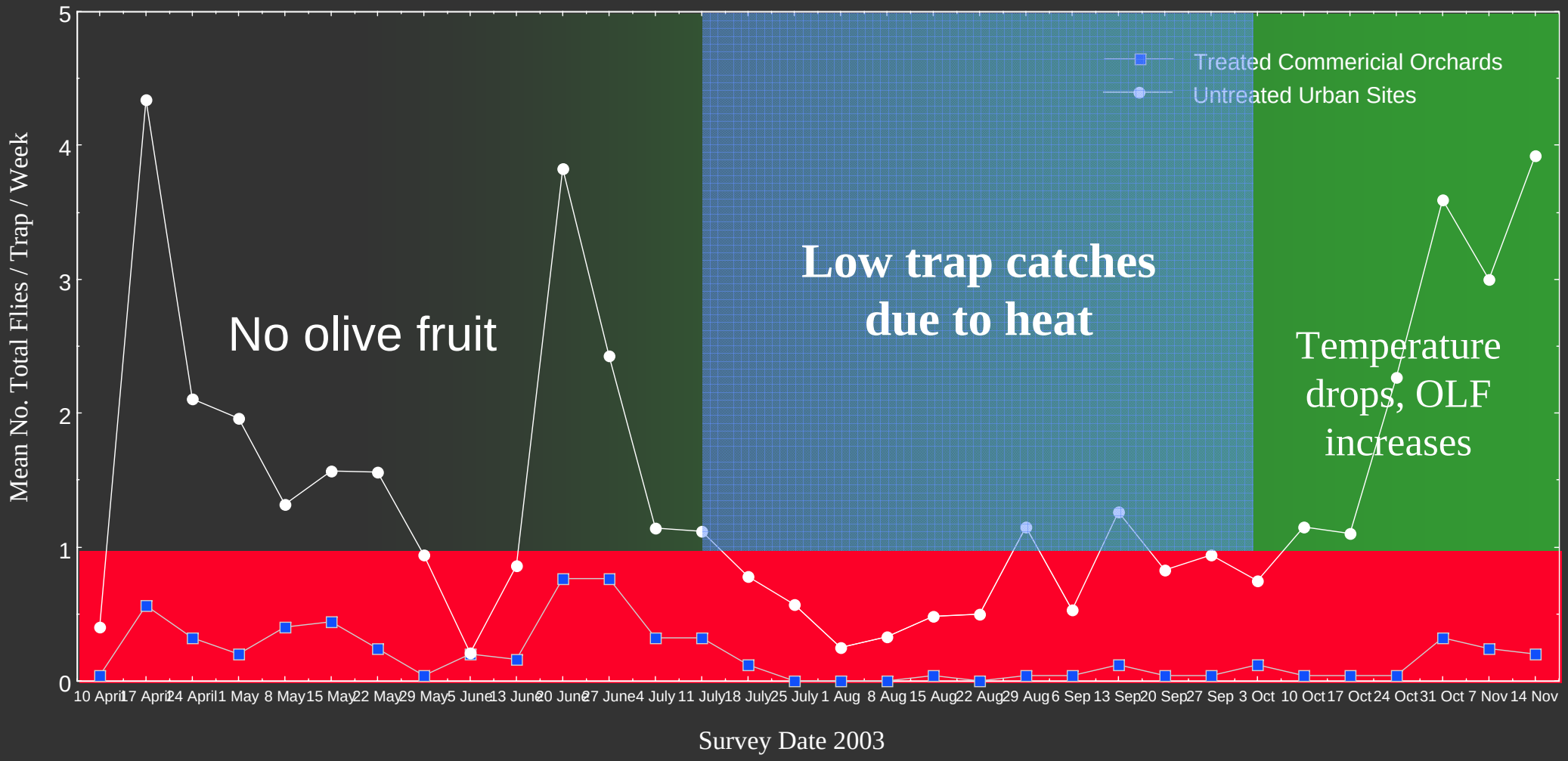
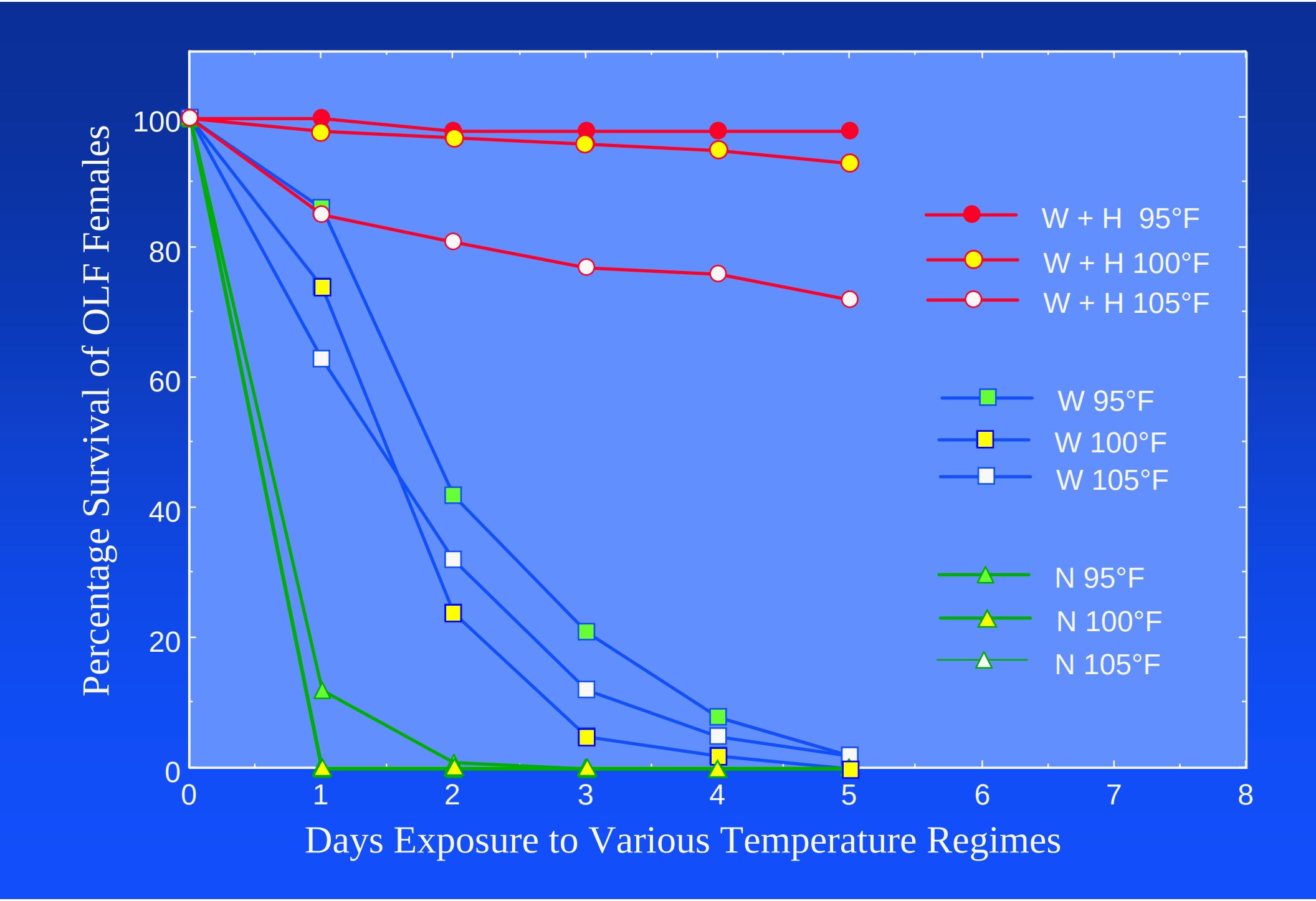


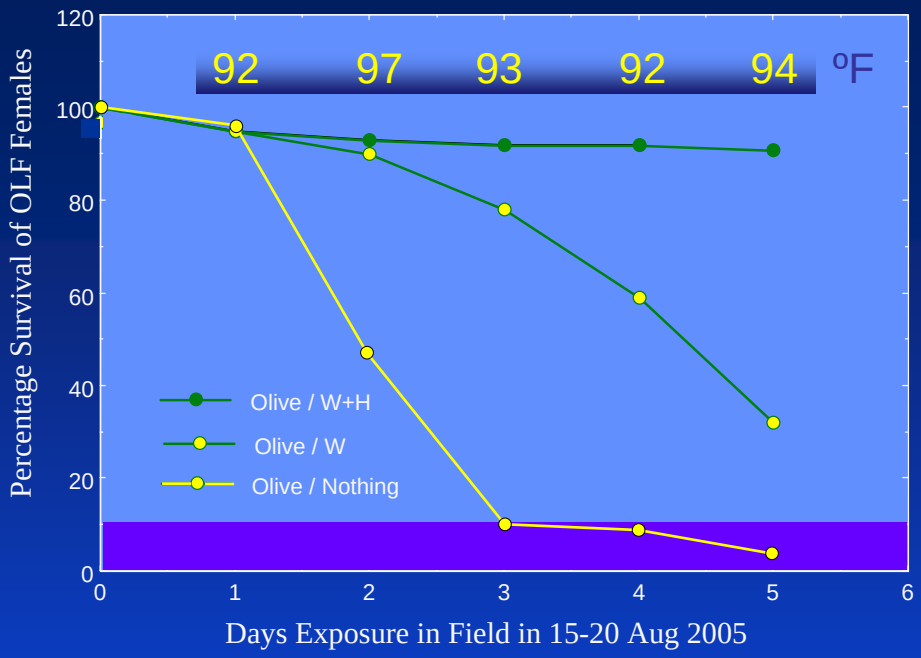
Why do we see a drop in trap catches?

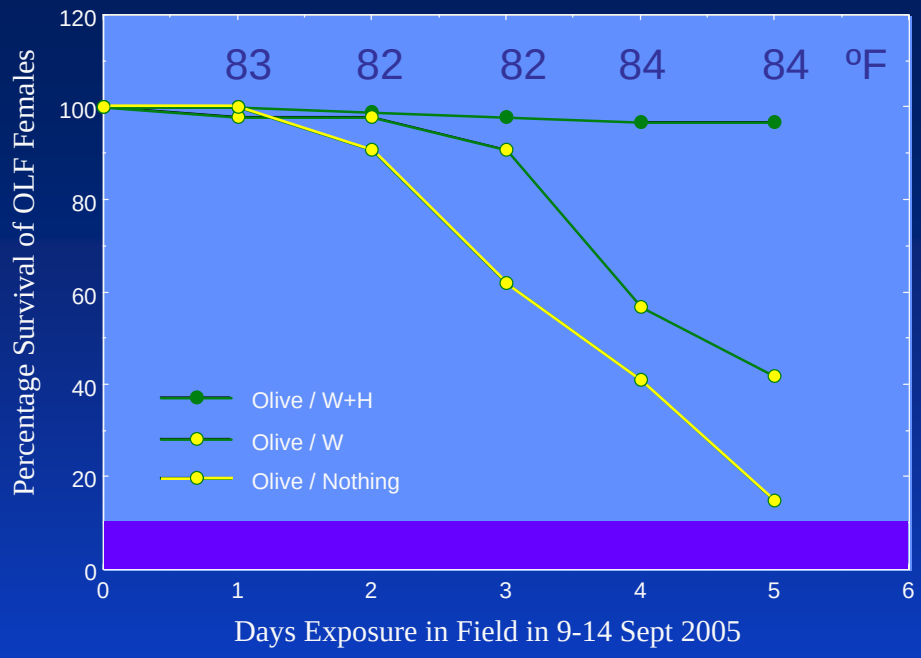
- The flies appear to alter their behavior patterns so that they are only active during cooler periods (i.e., early morning), thus less chance to be trapped.
- Extreme heat (greater than 95°F) can kill: 1) adult flies that cannot obtain enough water and sugar sources; and 2) eggs and 1st instars within the fruit. However, death may require 3 to 5 consecutive days of high temperatures.
- Flies with plenty of water and food can surive the entire summer (at least under field test conditions).
- The flies may leave the olive grove to seek out cooler, more humid places to sit out the extreme heat (e.g., citrus trees, low vegetation, etc.).

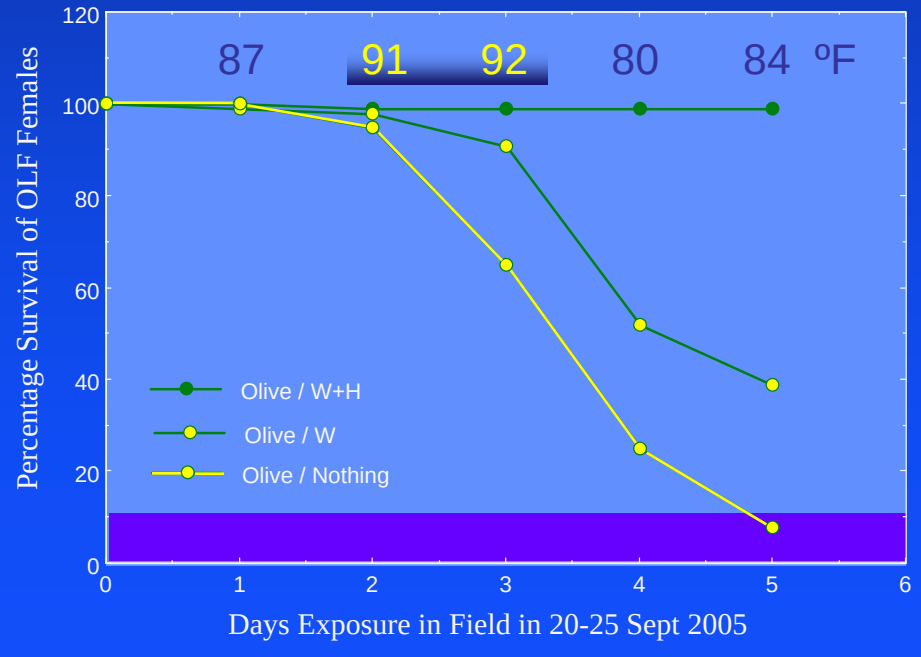

Percentage Survival of OLF Females
100
80
60
40
20
0
0
1
2
3
4
5
6
7
8
Days Exposure to Various Temperature Regimes
W + H 95°F
W + H 100°F
W + H 105°F
W 95°F
W 100°F
W 105°F
N 95°F
N 100°F
N 105°F

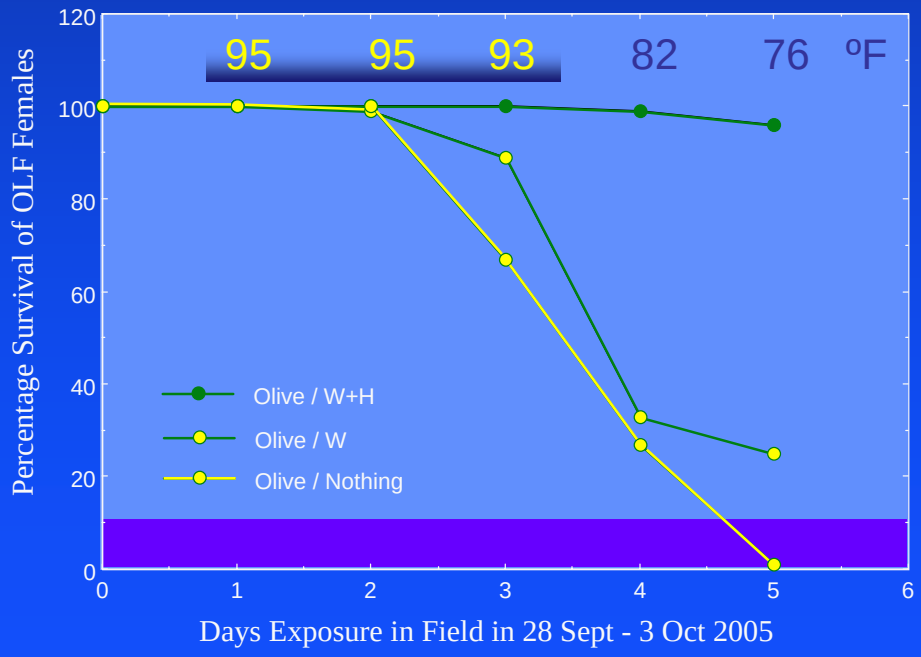

Tree Cage

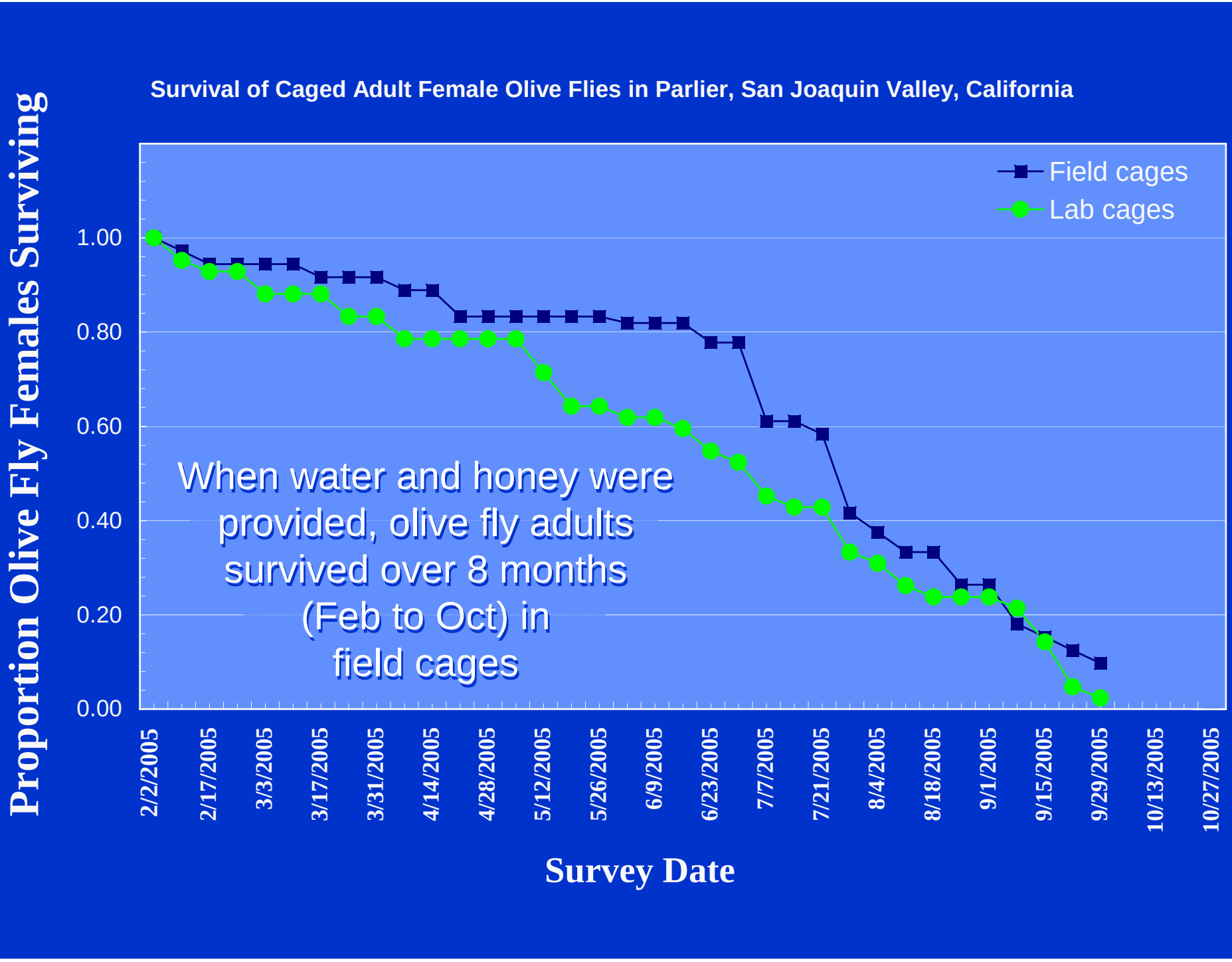
San Joaquin Valley: Parlier, CA

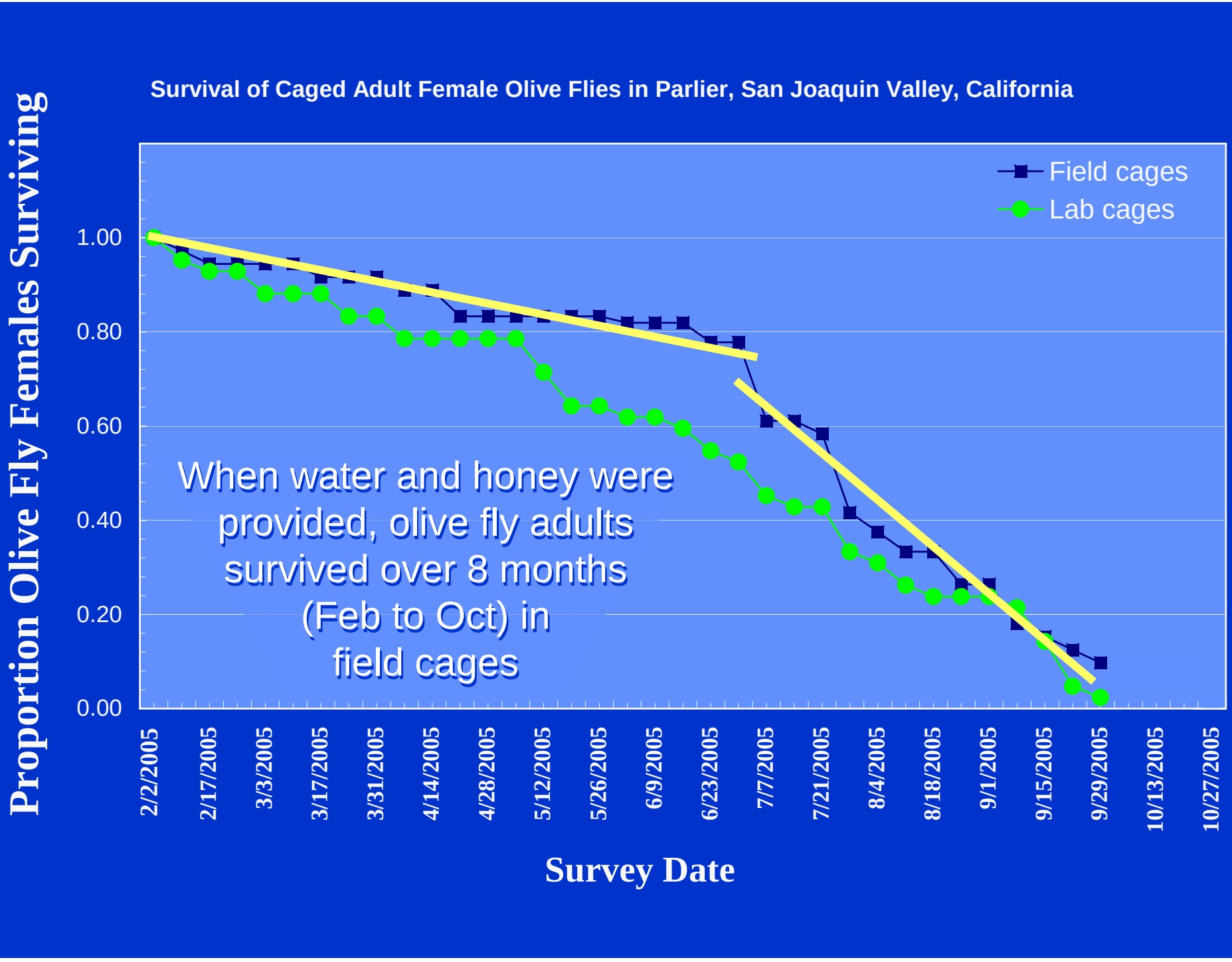









Survival of Caged Adult Female Olive Flies in Parlier, San Joaquin Valley, California
Proportion Olive Fly Females Surviving
1.00
0.80
0.60
0.40
0.20
0.00
Field cages
Lab cages
When water and honey were provided, olive fly adults survived over 8 months (Feb to Oct) in field cages
2/2/2005
2/17/2005
3/3/2005
3/17/2005
3/31/2005
4/14/2005
4/28/2005
5/12/2005
5/26/2005
6/9/2005
6/23/2005
7/7/2005
7/21/2005
8/4/2005
8/18/2005
9/1/2005
9/15/2005
9/29/2005
10/13/2005
10/27/2005
Survey Date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7/7/2005
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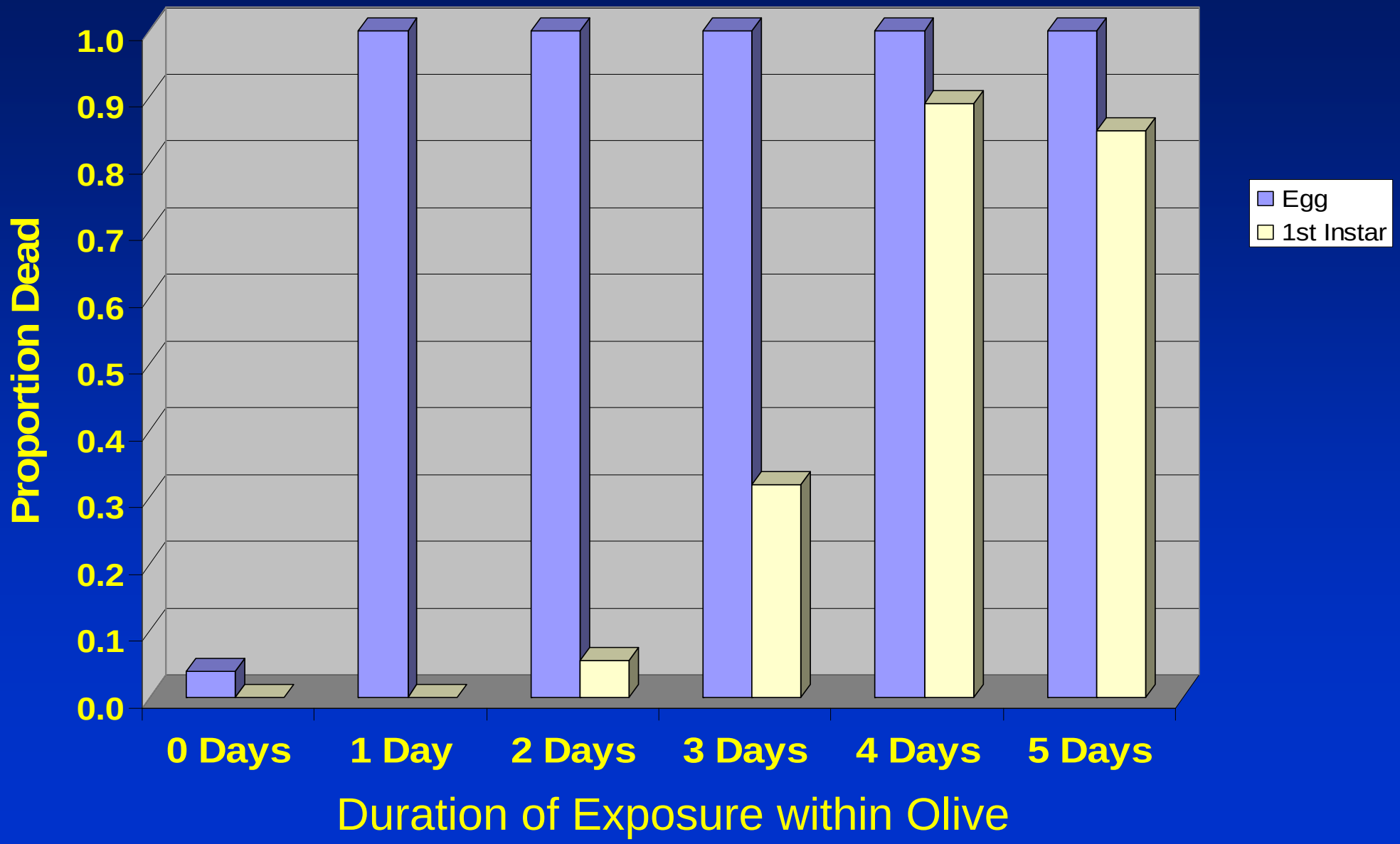
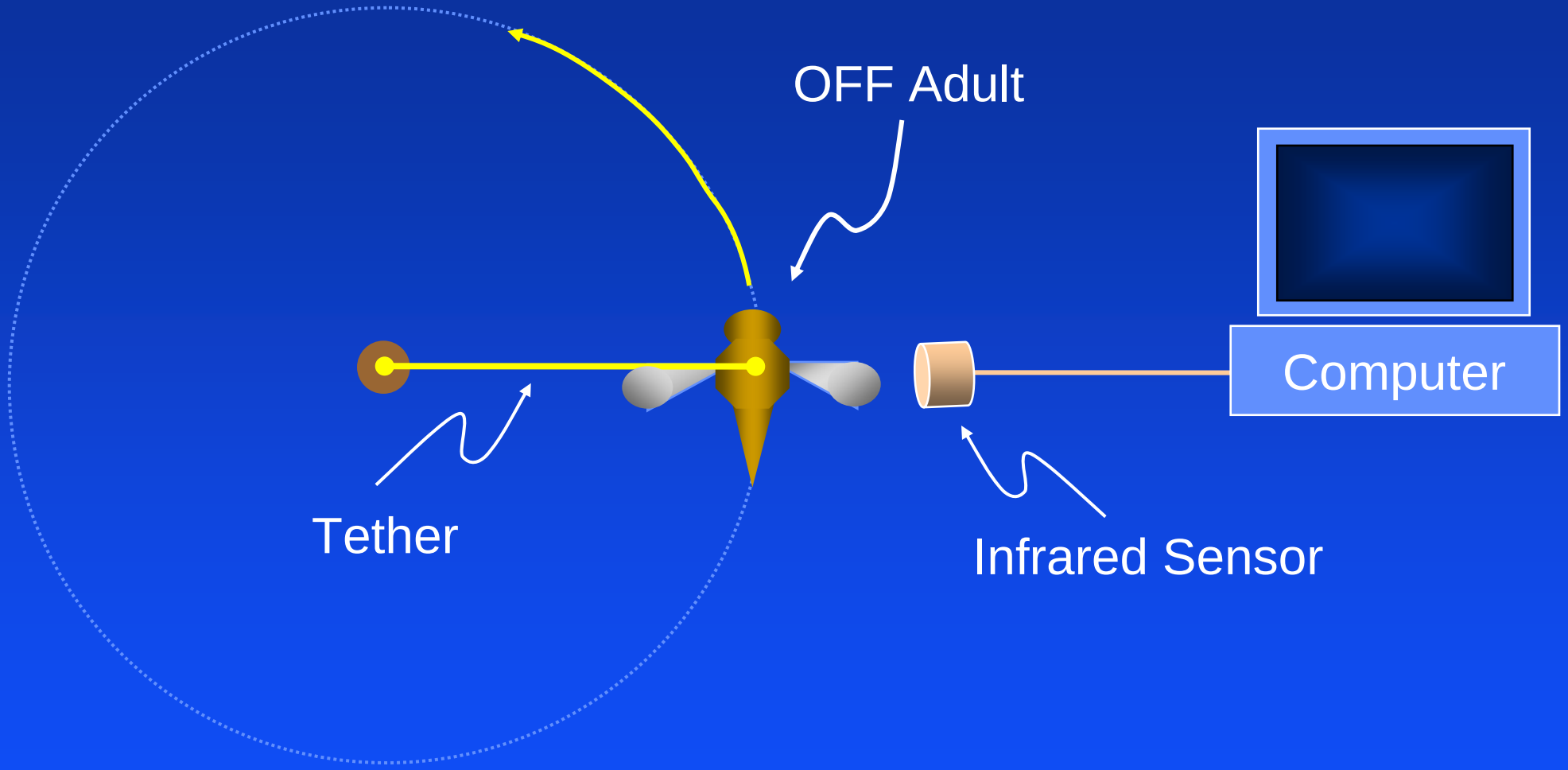
8/4/2005
8/18/2005
9/1/2005
9/15/2005
9/29/2005
10/13/2005
10/27/2005
Survey Date

What is the impact of high temperatures on olive fly eggs and first instars?

Mortality of OLF stages after 0 to 5 Days Exposure to 100ºF



Schematic of Flight Mill



Flies were tested using a flight mill to see if high temperatures impacted their ability to fly. Flies were tested at 2 temperature regimes (75°F and 75/100°F) and given different diets.

Effects of Temperature on Olive Fly Flight Abilities

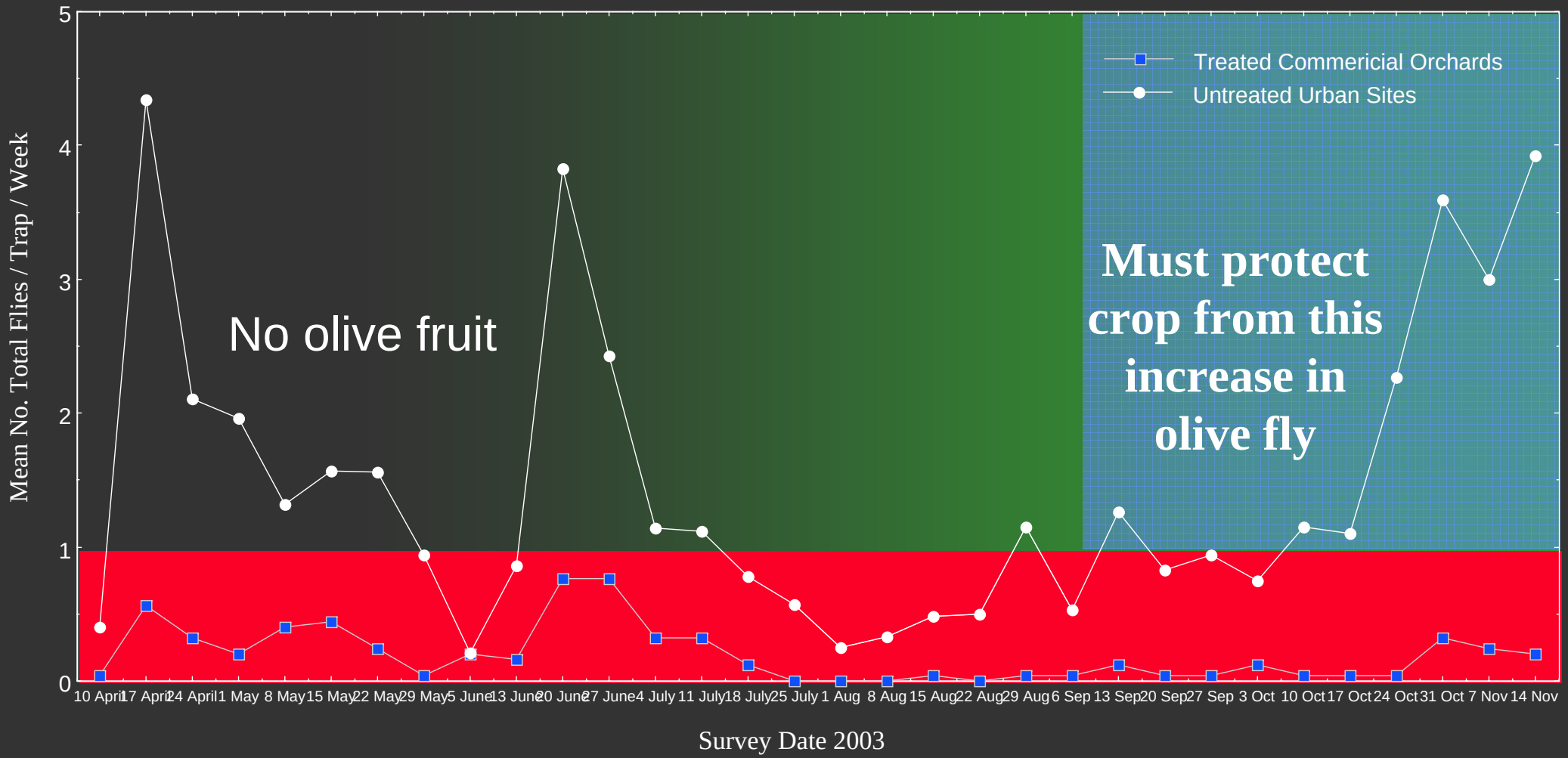
Olive fly adults must seek out water and food to survive.

- Flies that are well fed and watered can fly on average 6,502 feet in 1.54 hours.
- Flies that received both food and water and were then exposed to 100°F for 3 days could only fly 1,486 feet in 0.38 hours
- Flies that only received food (and no water) and were then exposed to 100°F for 3 days could only fly 662 feet in 0.18 hours
- Flies that received no food or water upon emergence from the pupae and exposed to 100°F for 3 days could only fly 49 feet in 0.014 hours.

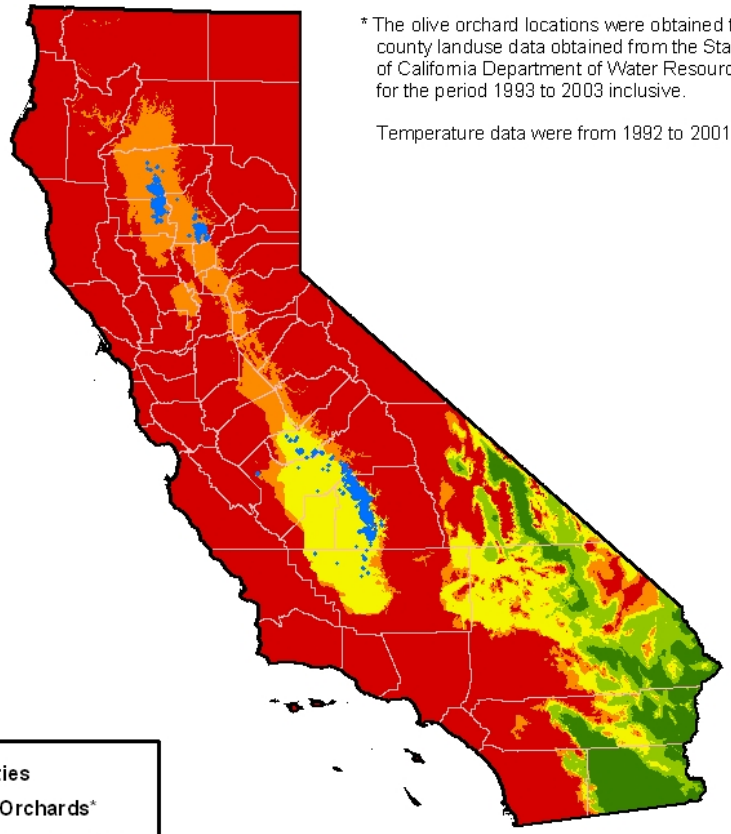
Other Factors to Consider

- Based on historical temperature data from the Central Valley, the frequency at which 3 to 5-day periods of 100 to 105°F occur vary dramatically between the olive production areas of the San Joaquin Valley versus the Sacramento Valley
- The San Joaquin Valley has longer and more frequent periods of high temperatures than the Sacramento Valley
- Irrigation methods vary between the regions with the San Joaquin Valley having dryer orchards with little ground cover within orchards to provide moisture, shade, and high humidity for OLF adults
- Black scale, *Saissetia oleae*, is common throughout the Central Valley and produces honeydew that flies may potentially use as a carbohydrate source

Average Adult Olive Fly Trap Counts in Tulare & Fresno Counties



Number of Years with Maximum Temperatures Greater Than or Equal to 100 deg F For Three Consecutive Days Ending on July 15



* The olive orchard locations were obtained from county landuse data obtained from the State of California Department of Water Resources for the period 1993 to 2003 inclusive.

Temperature data were from 1992 to 2001, inclusive.

Counties
Olive Orchards*
Number of Years Satisfying Temperature Criteria
0
1 - 2
3 - 5
6 - 8
9 - 10

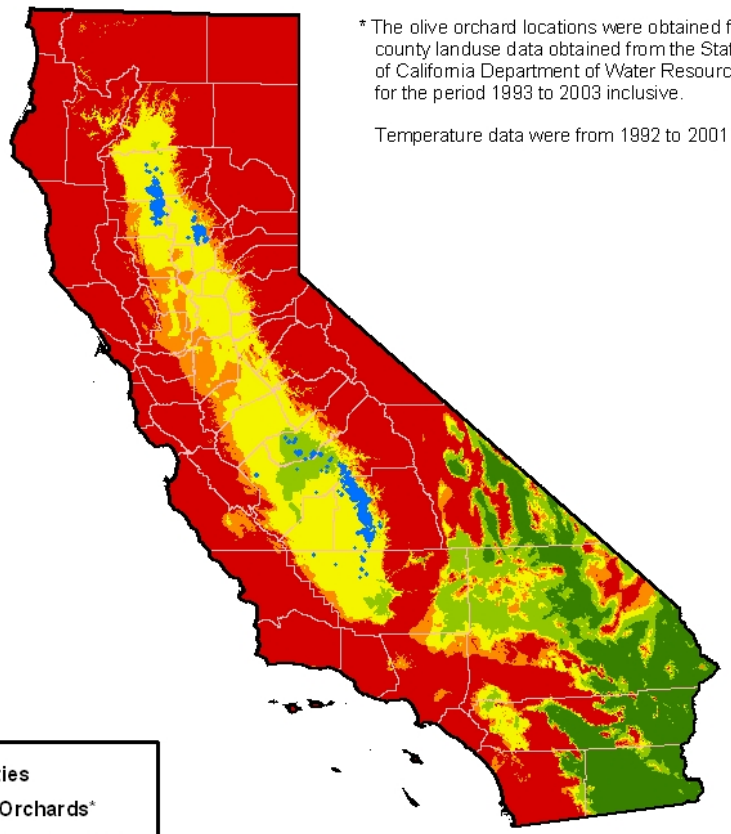
N
W E
S

0 50 100 200 300 400 Kilometers

Temperature Data Analyzed and Map Prepared by the UC Kearney Agricultural Center GIS Facility

UCKAC GIS

Number of Years with Maximum Temperatures Greater Than or Equal to 100 deg F For Three Consecutive Days Ending on August 15



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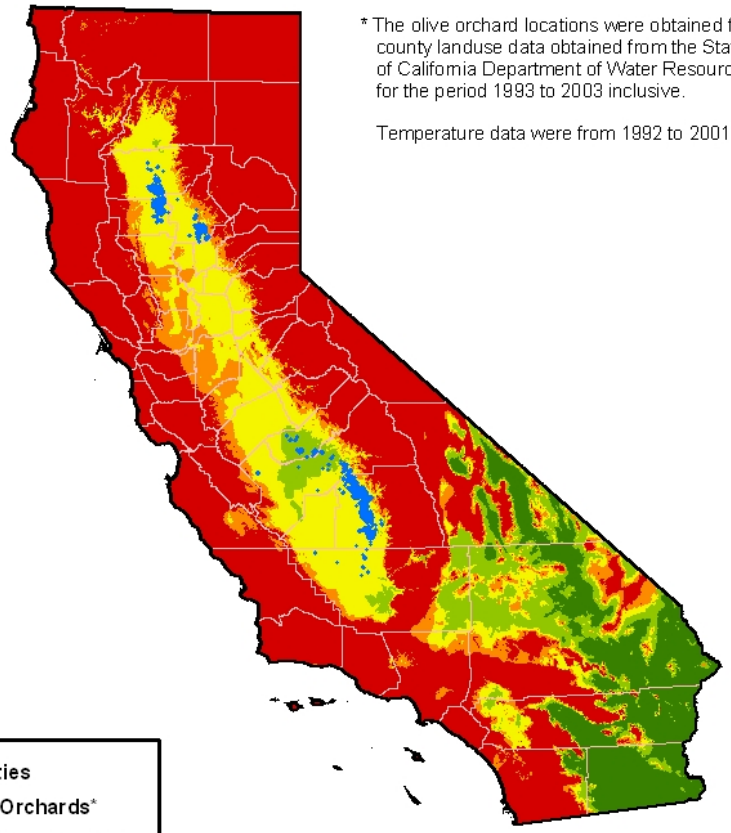

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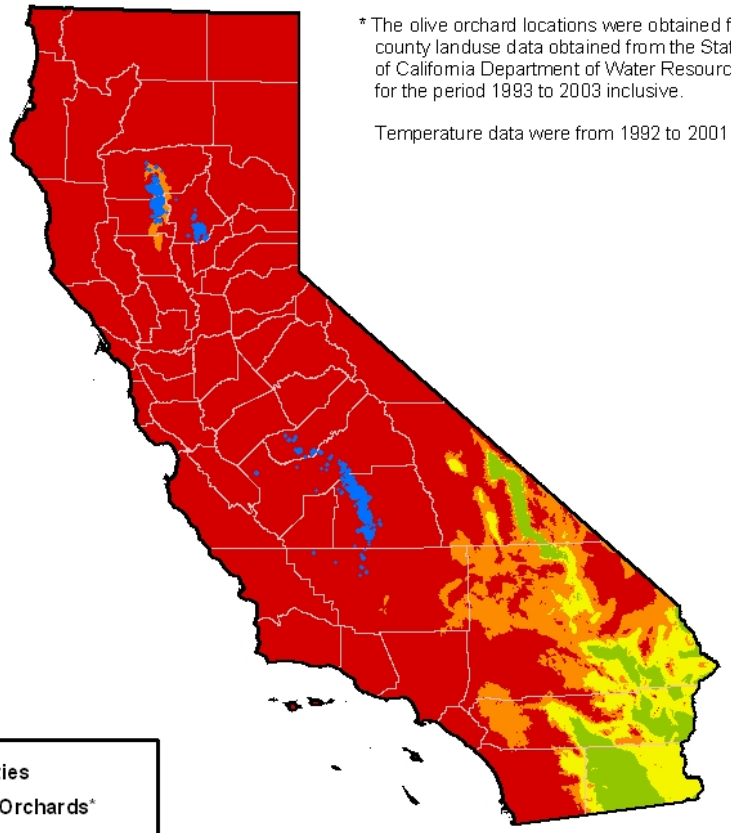

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N
W E
S

0 50 100 200 300 400 Kilometers

Temperature Data Analyzed and Map Prepared by the UC Kearney Agricultural Center GIS Facility

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Snapz Pro X

UCKAC GIS

University of California Kearney Agricultural Center
Geographic Information Systems Facility

PROJECTS

- Commodity and Research Mapping
- County Soils Maps
- Citrus Peelminer Survey
- Citrus Leafminer Survey
- Mosquito Research
- Avocado Thrips
- **Temperature Threshold Maps for Olive Fly Management**

- **GIS Support for Cooperative Extension**
- GIS Links
- TUTORIALS
- MEETINGS
- CONTACT INFORMATION
- KAC HOME

Last updated:04/12/2007

Go to webpage at:
http://gis.uckac.edu/

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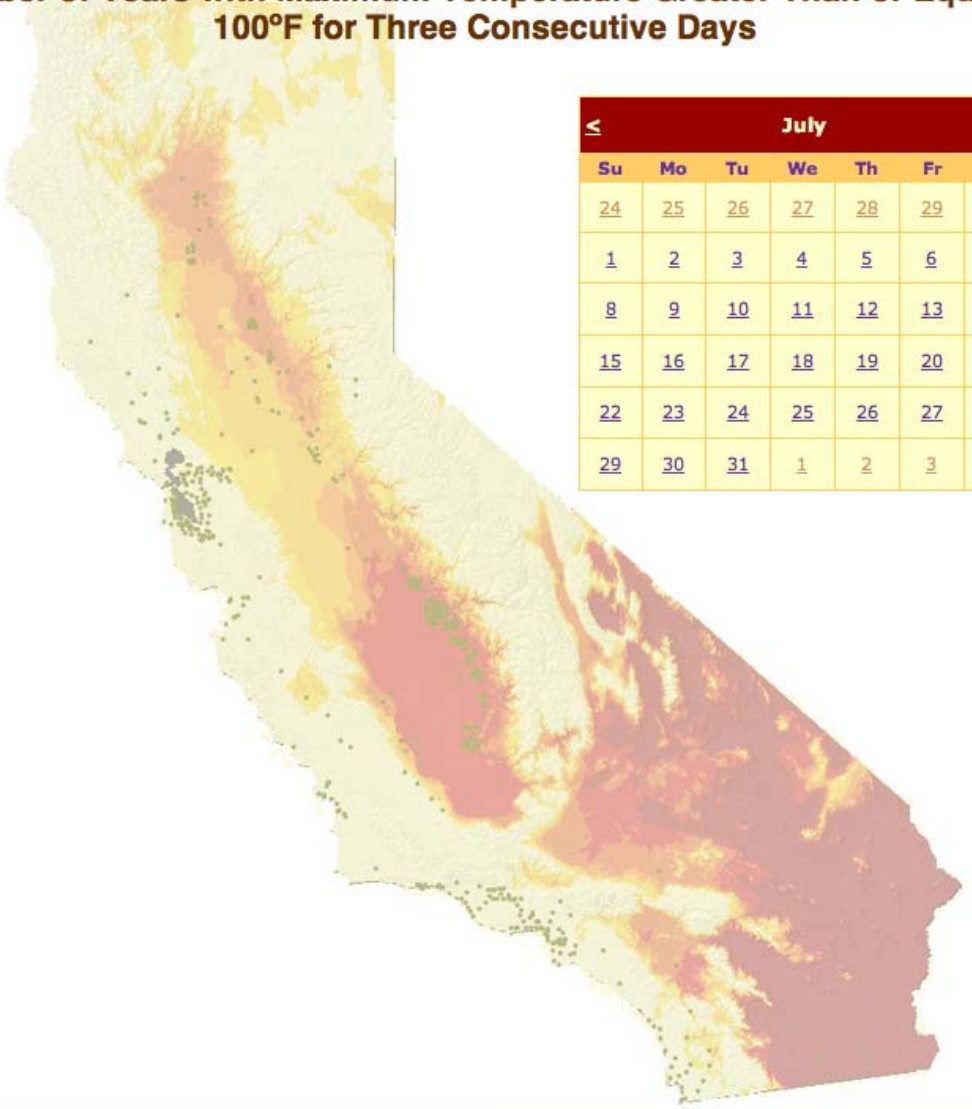

≤			July			≥
Su	Mo	Tu	We	Th	Fr	Sa
24	25	26	27	28	29	30
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	1	2	3	4

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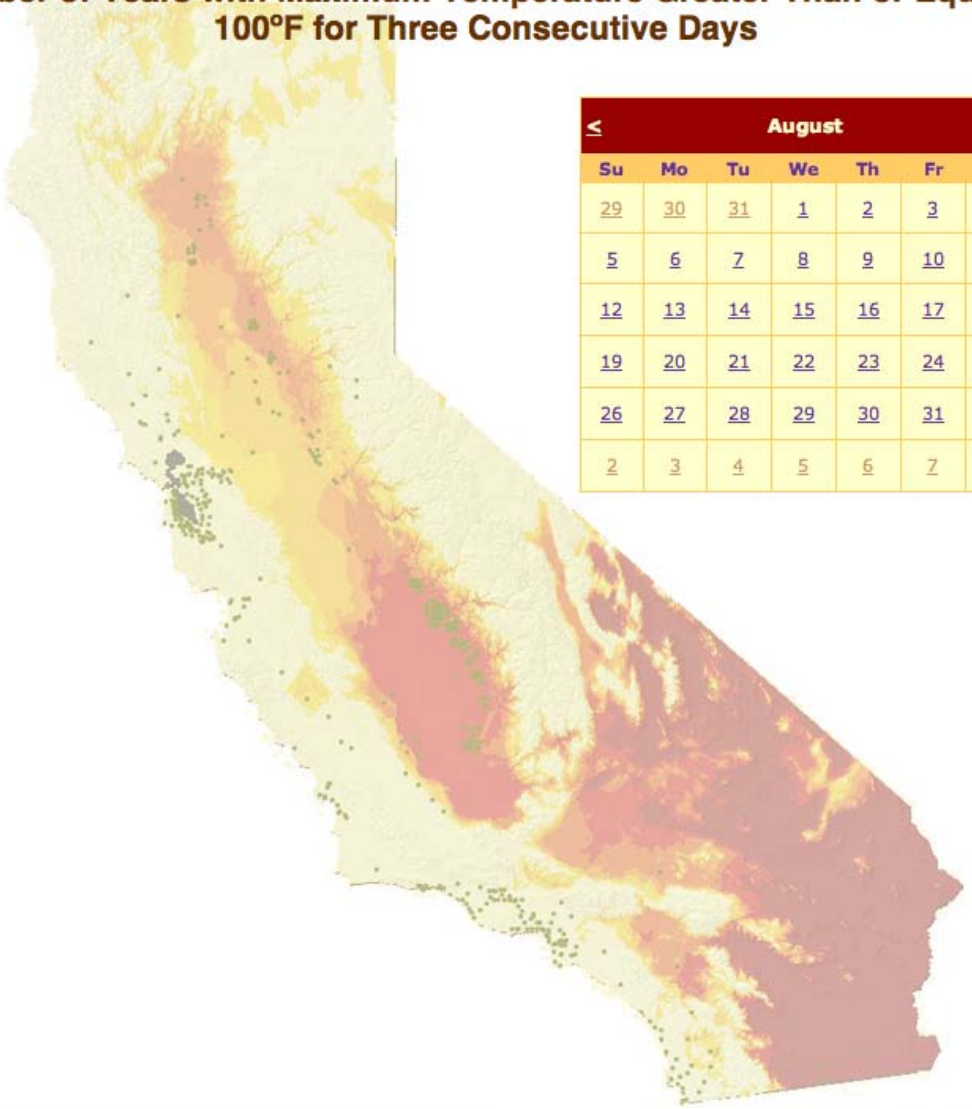

≤	August					≥
Su	Mo	Tu	We	Th	Fr	Sa
29	30	31	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	1
2	3	4	5	6	7	8

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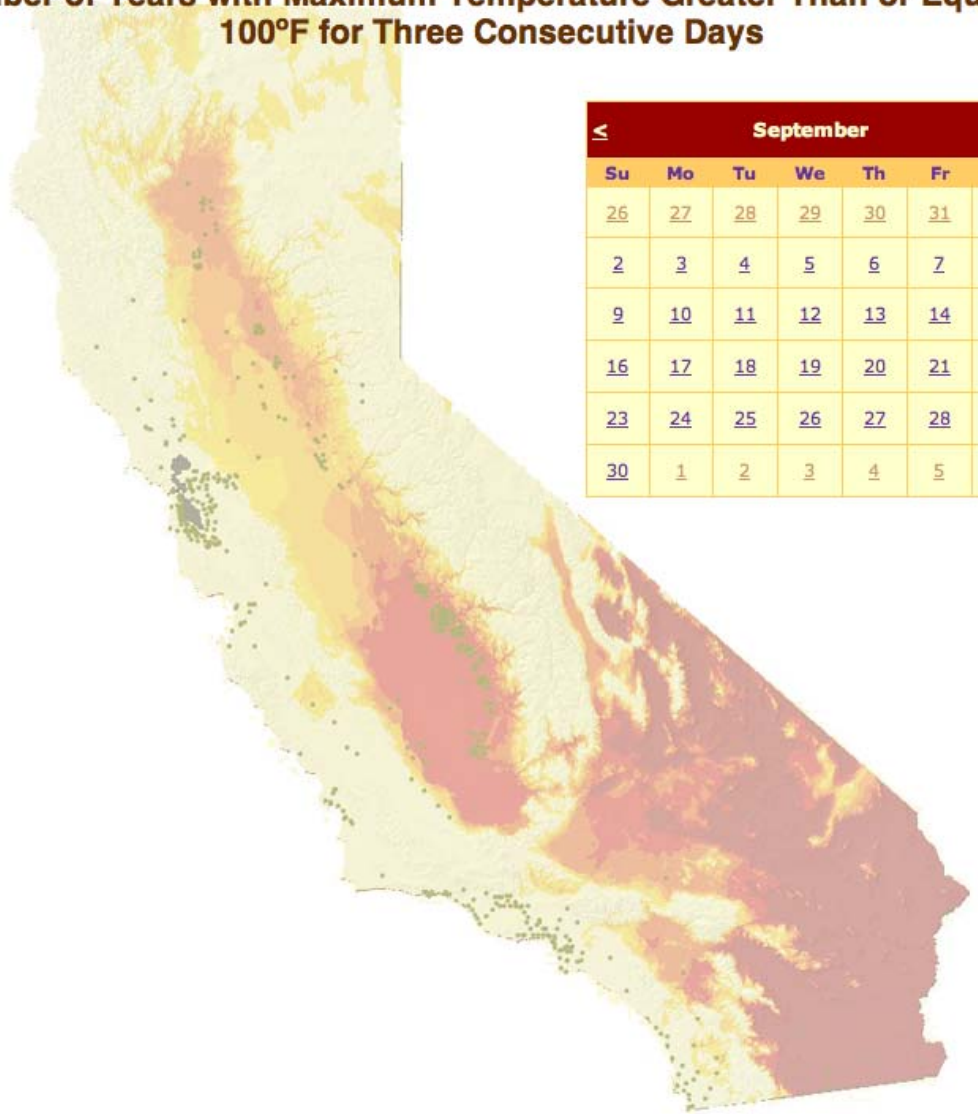

≤			September			≥
Su	Mo	Tu	We	Th	Fr	Sa
26	27	28	29	30	31	1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	1	2	3	4	5	6

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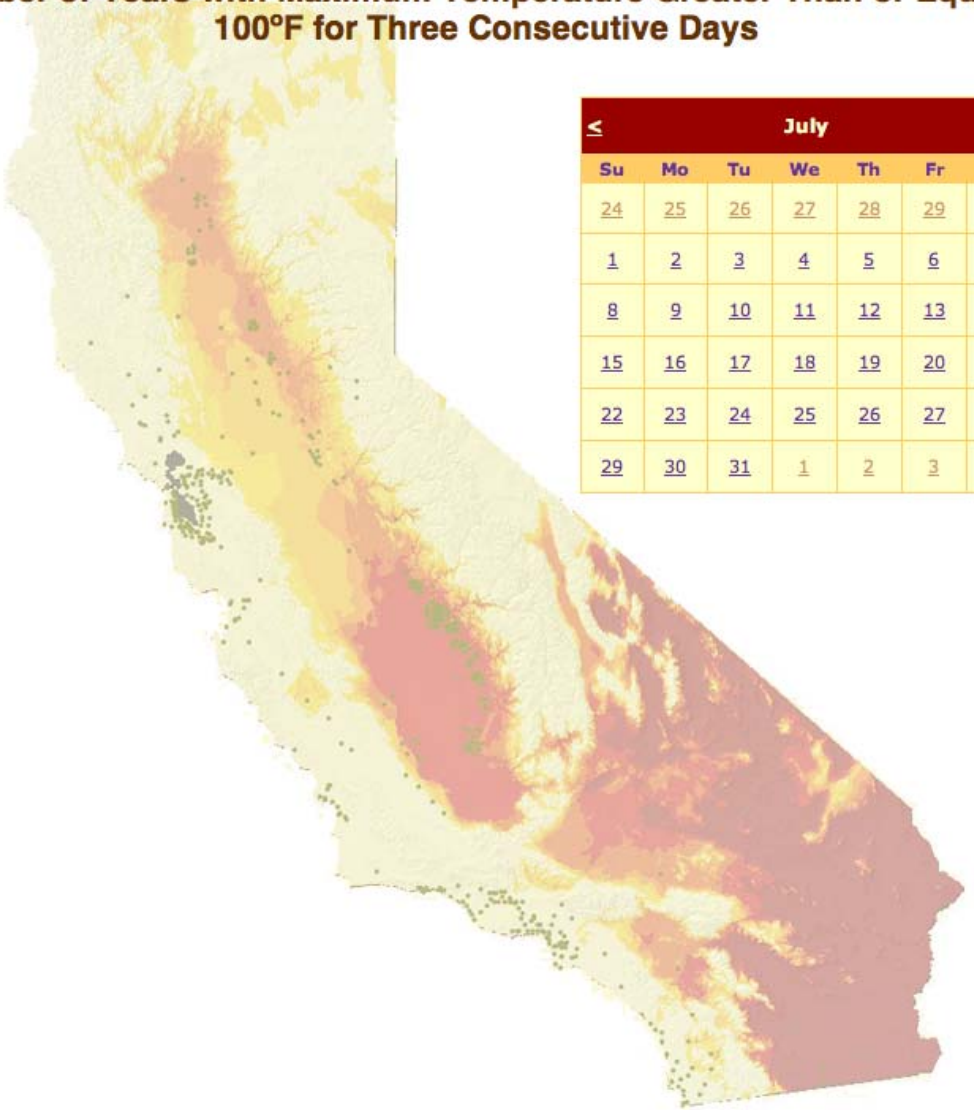

≤		July				≥
Su	Mo	Tu	We	Th	Fr	Sa
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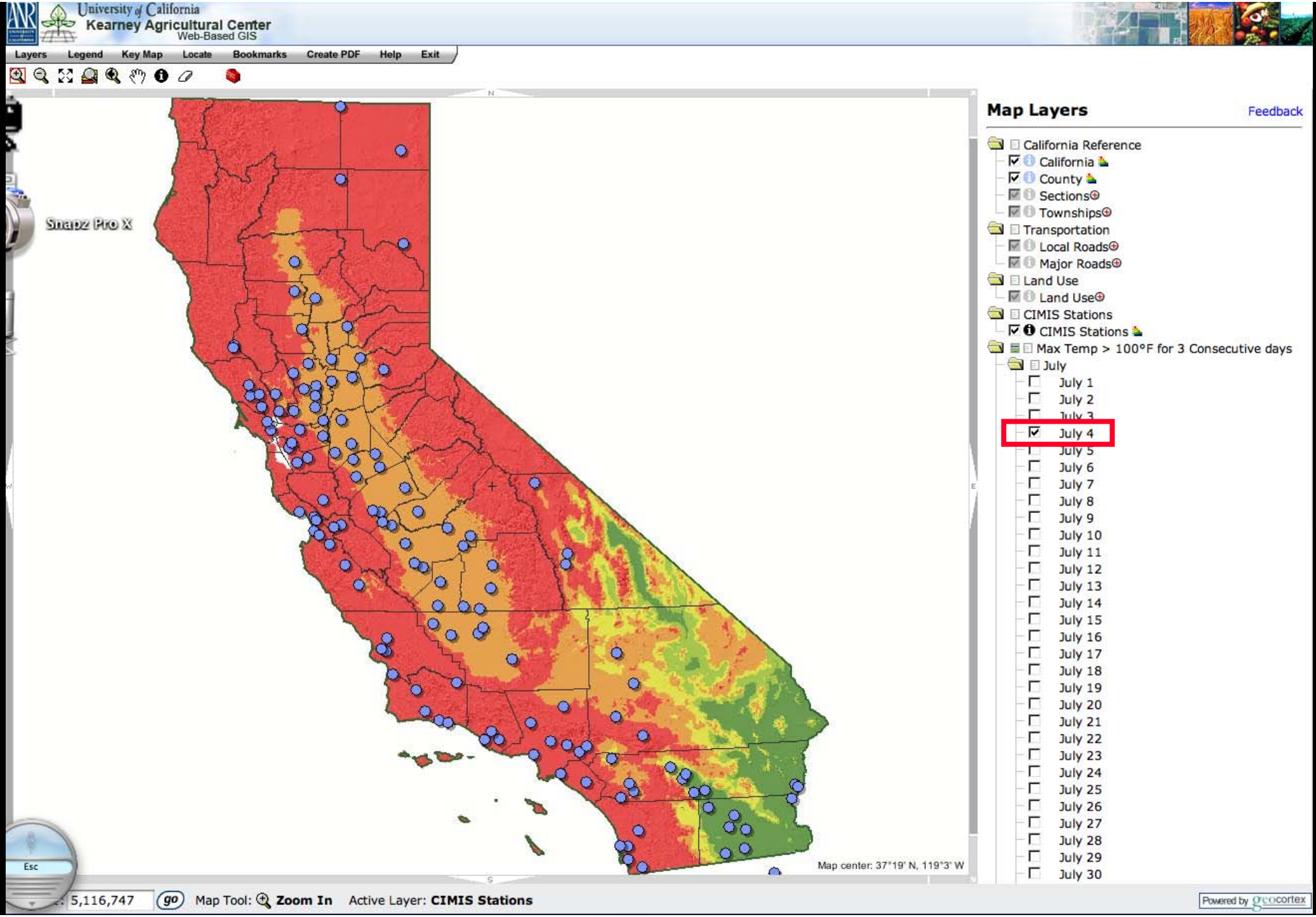
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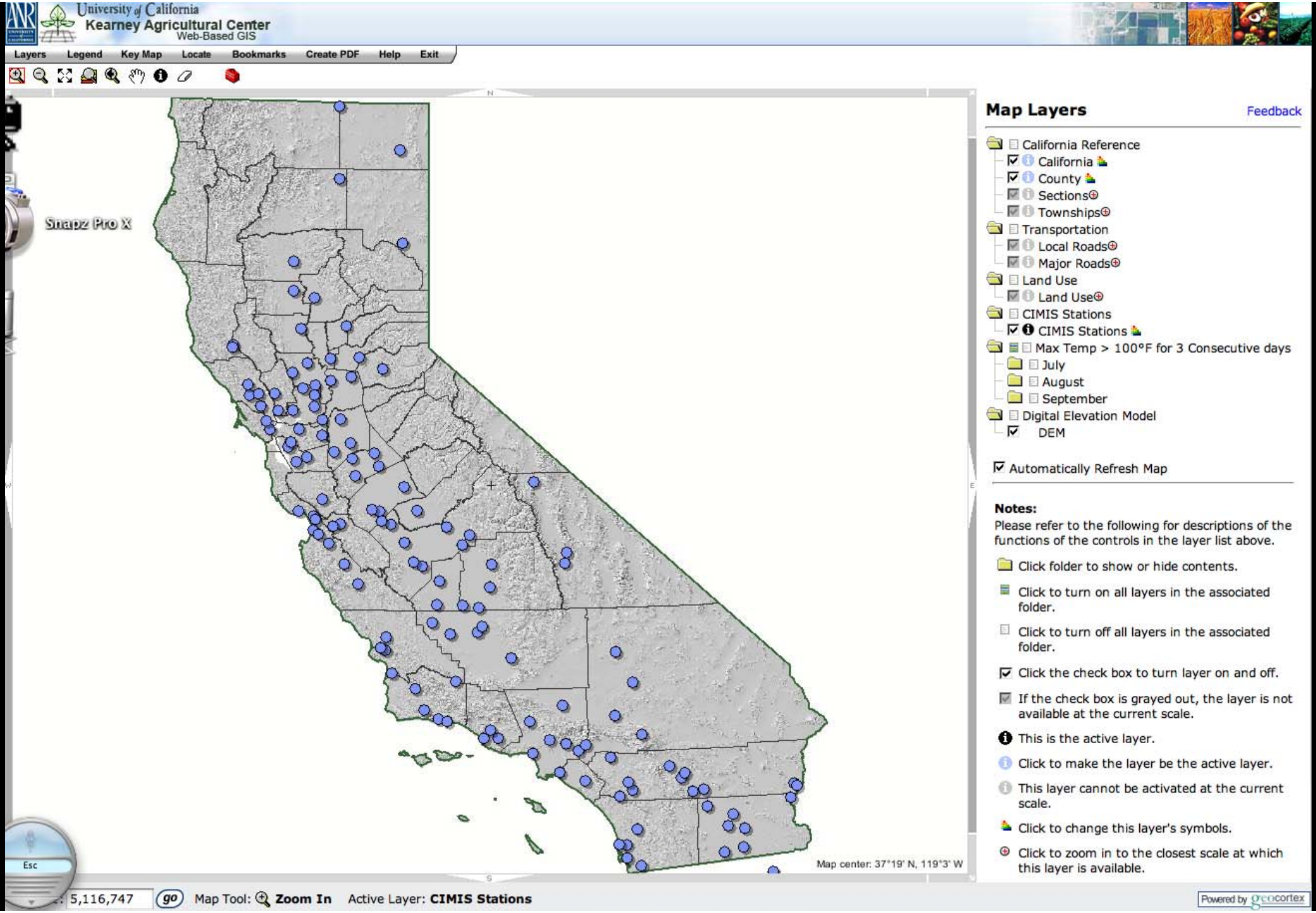
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Click the check box to turn layer on and off.
If the check box is grayed out, the layer is not available at the current scale.
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Click to make the layer be the active layer.
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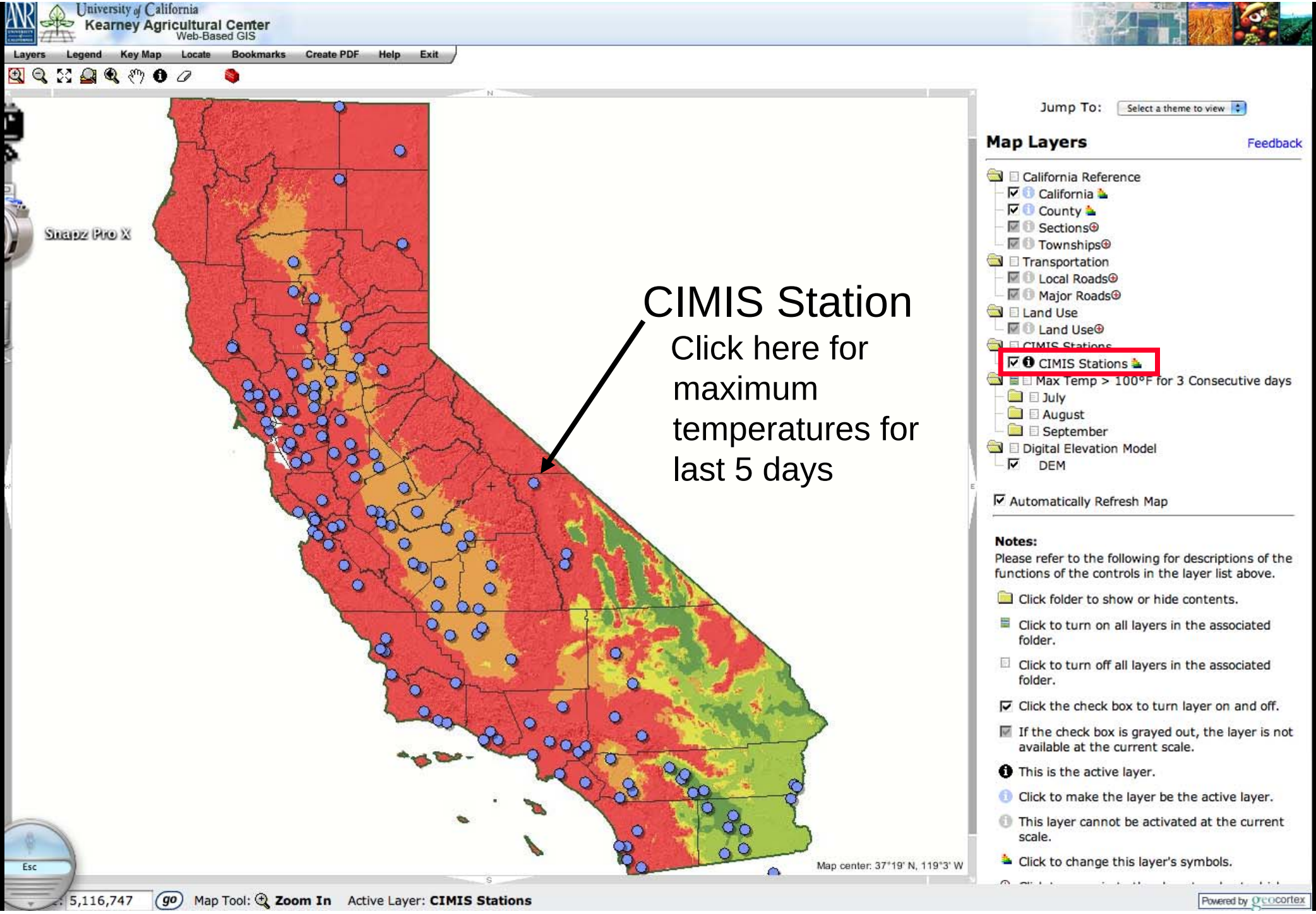
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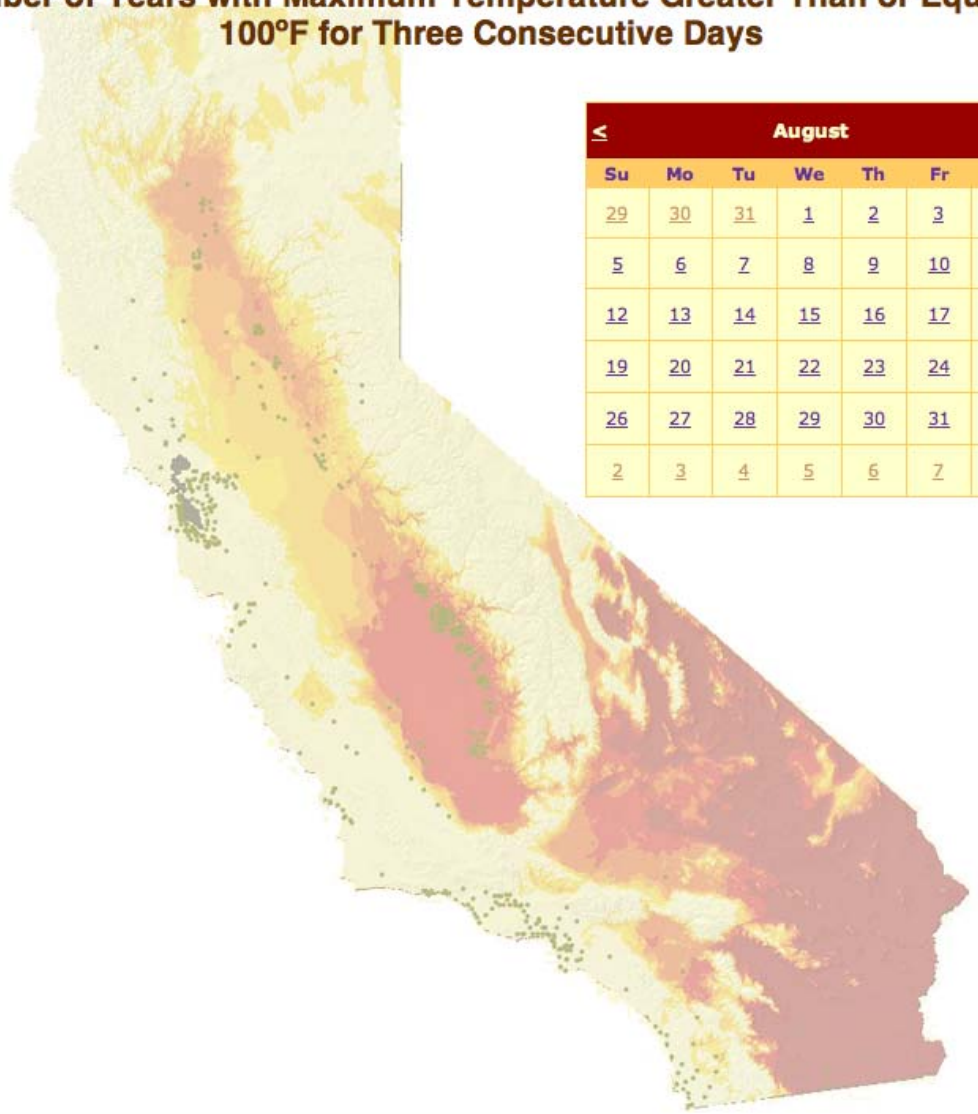
Number of Years with Maximum Temperature Greater Than or Equal to 100°F for Three Consecutive Days



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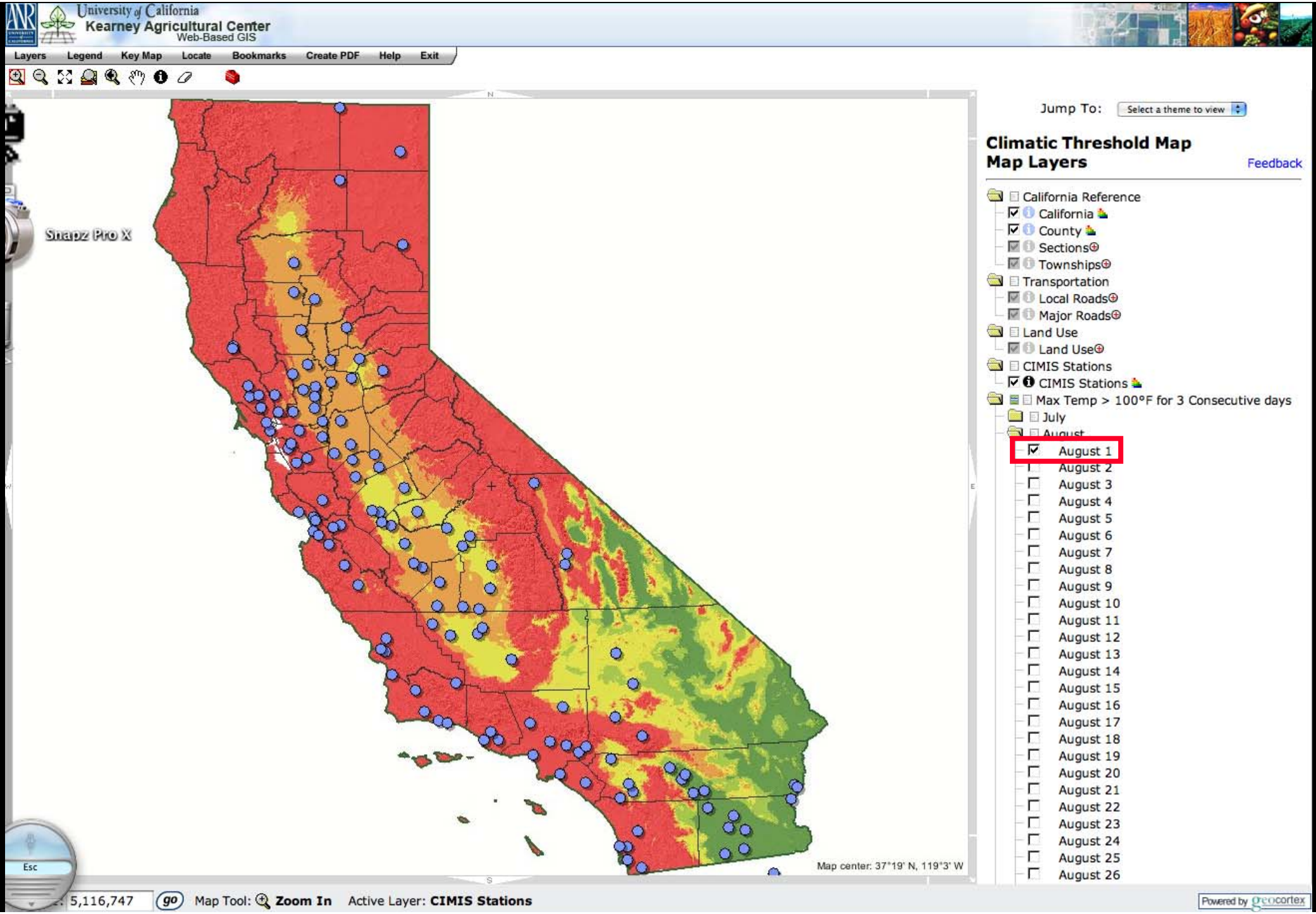
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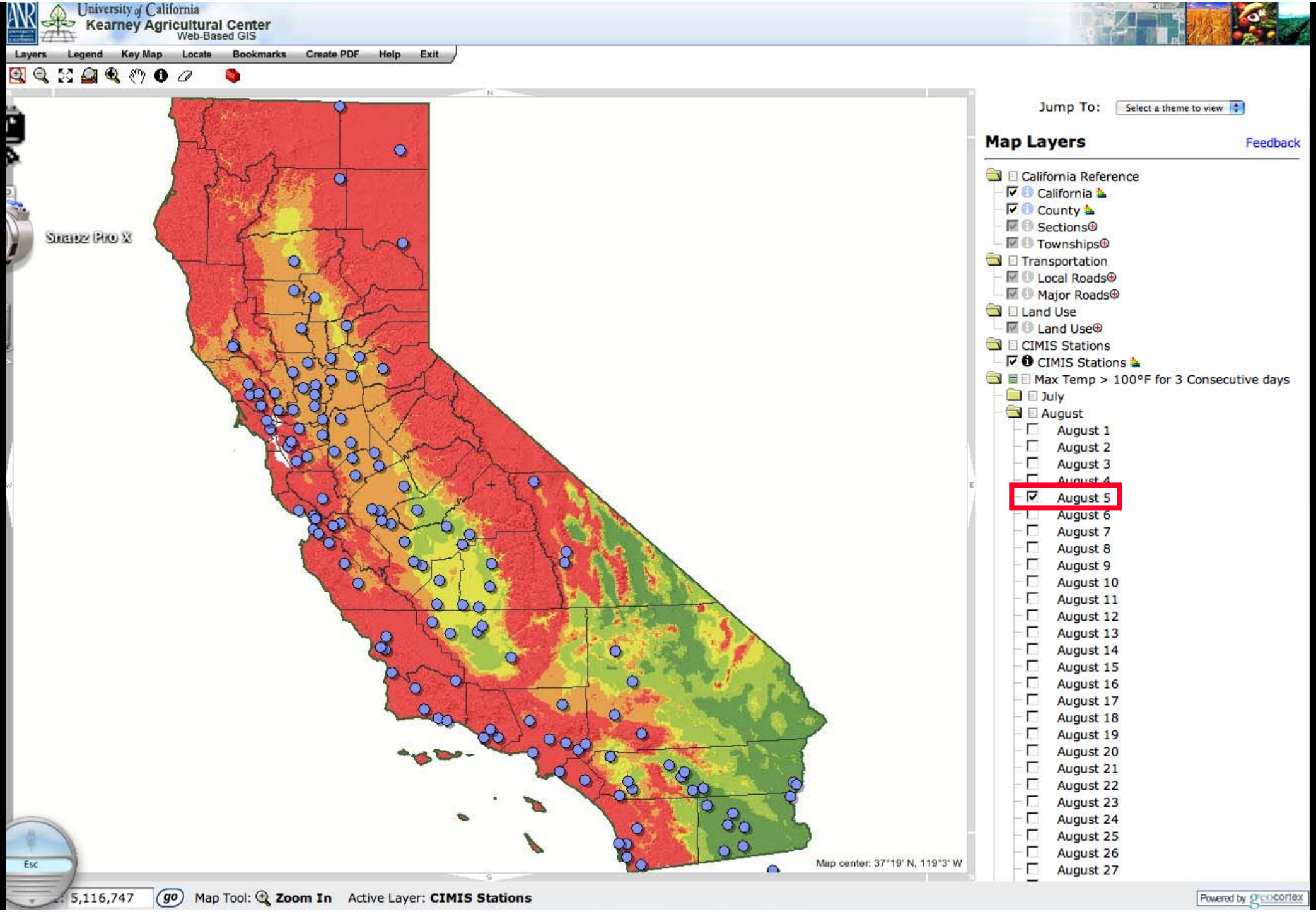
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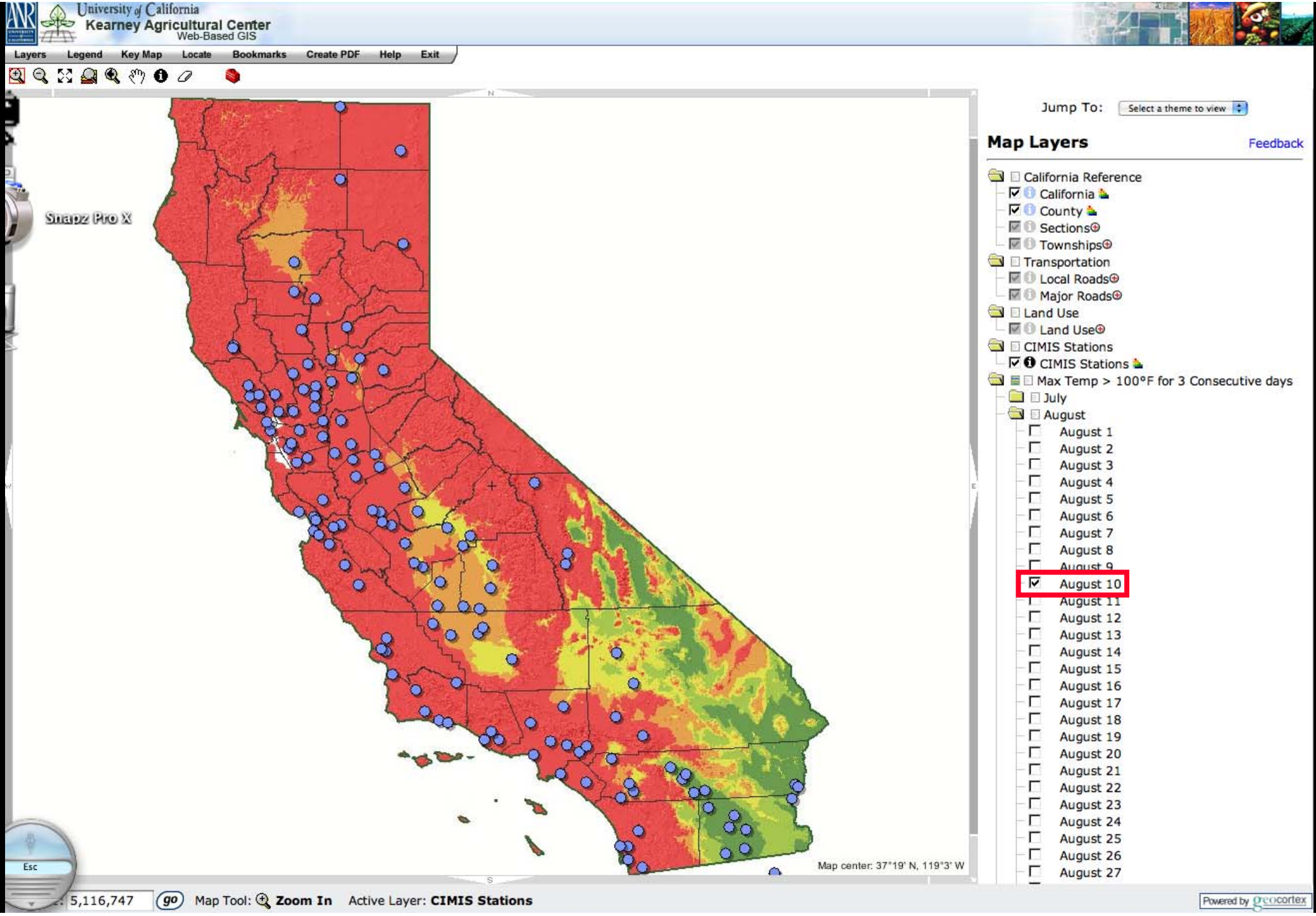
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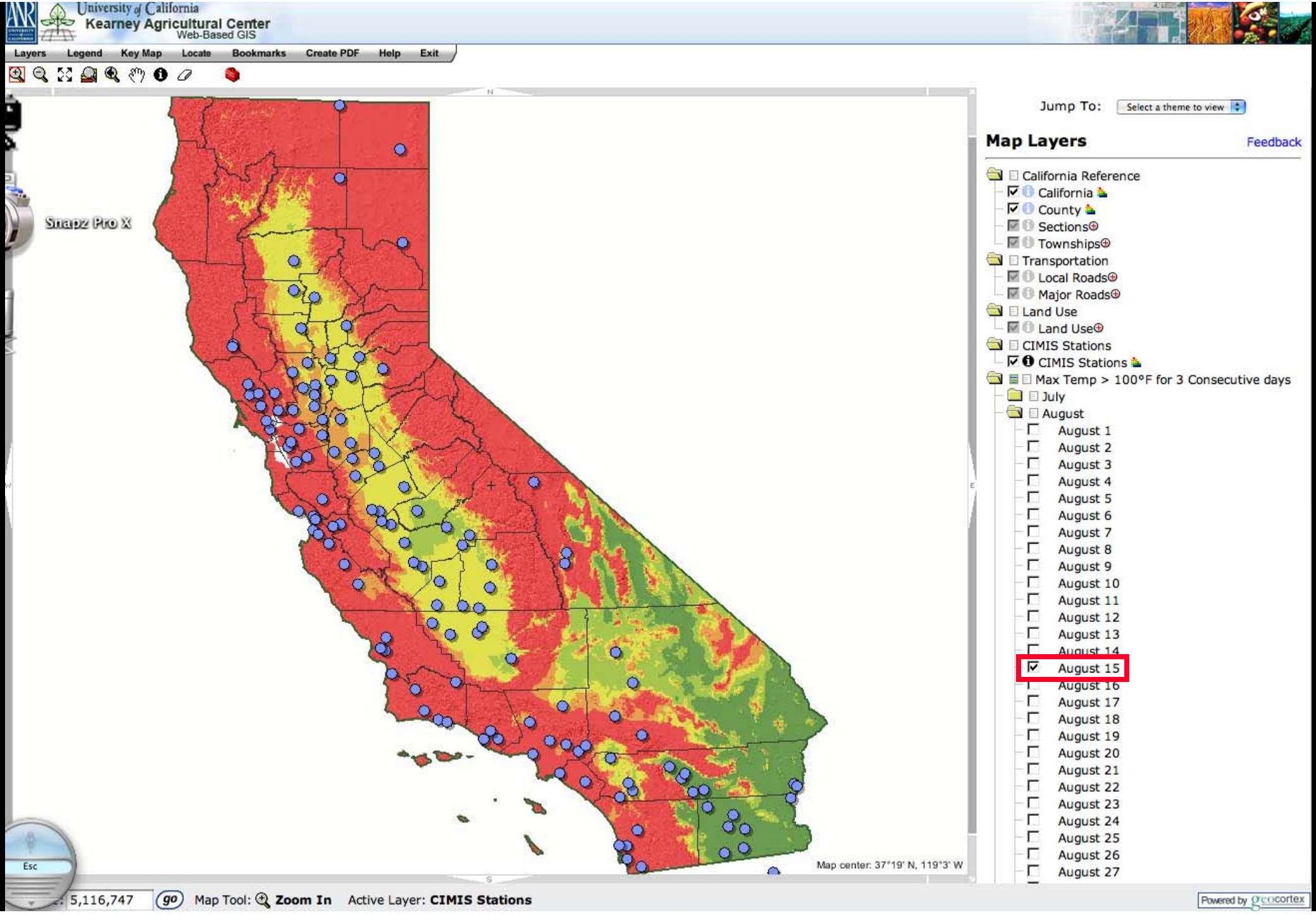
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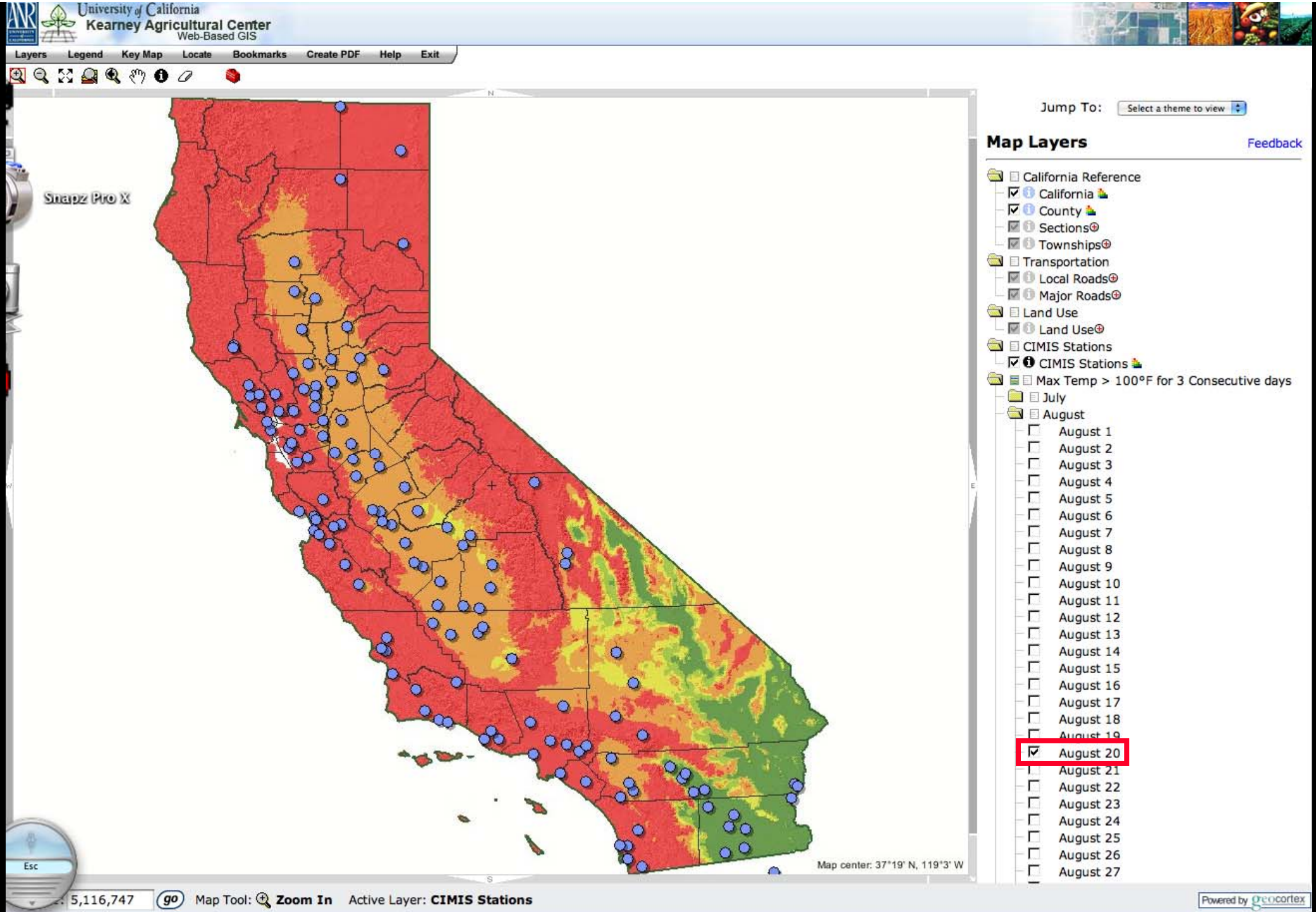
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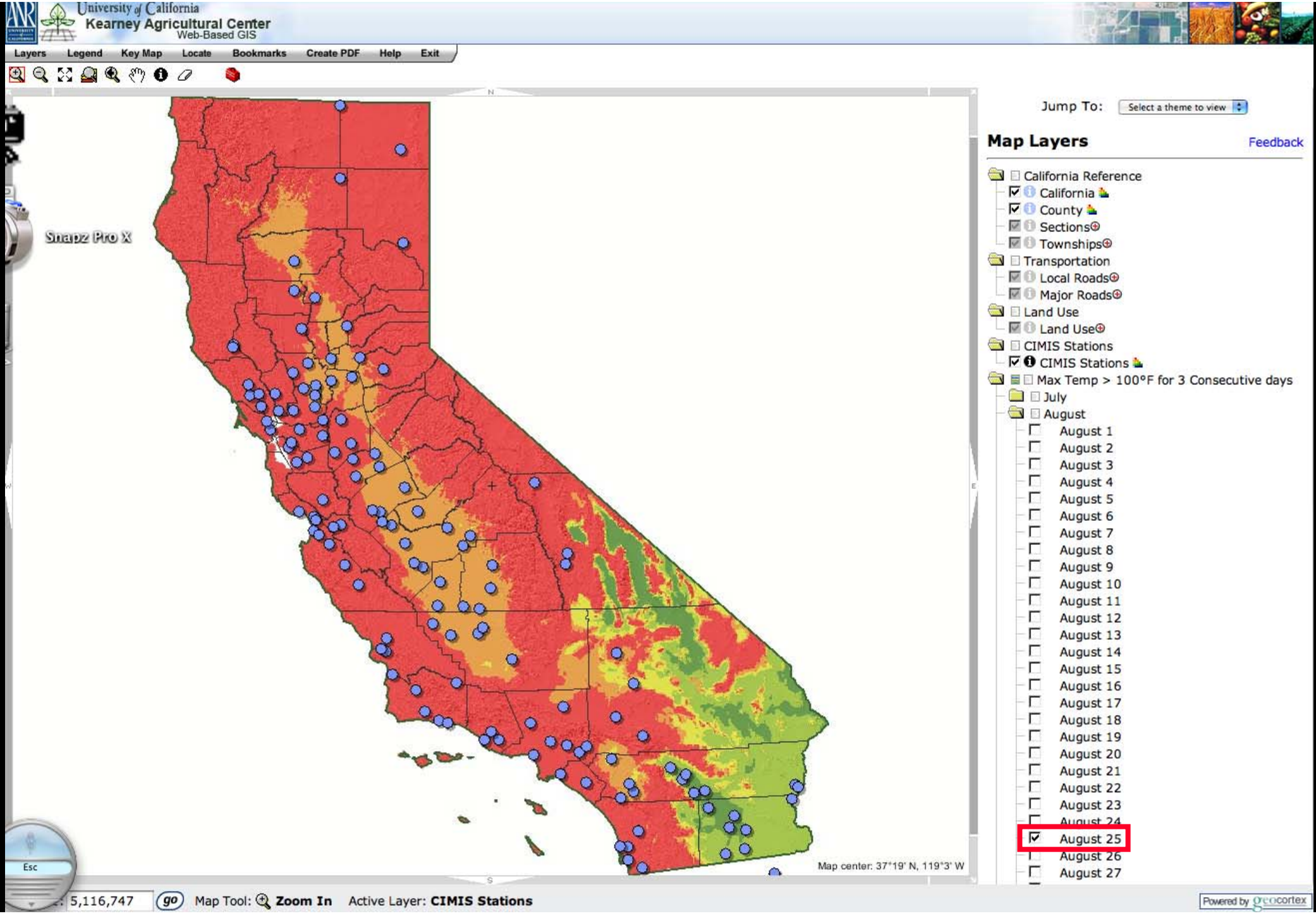
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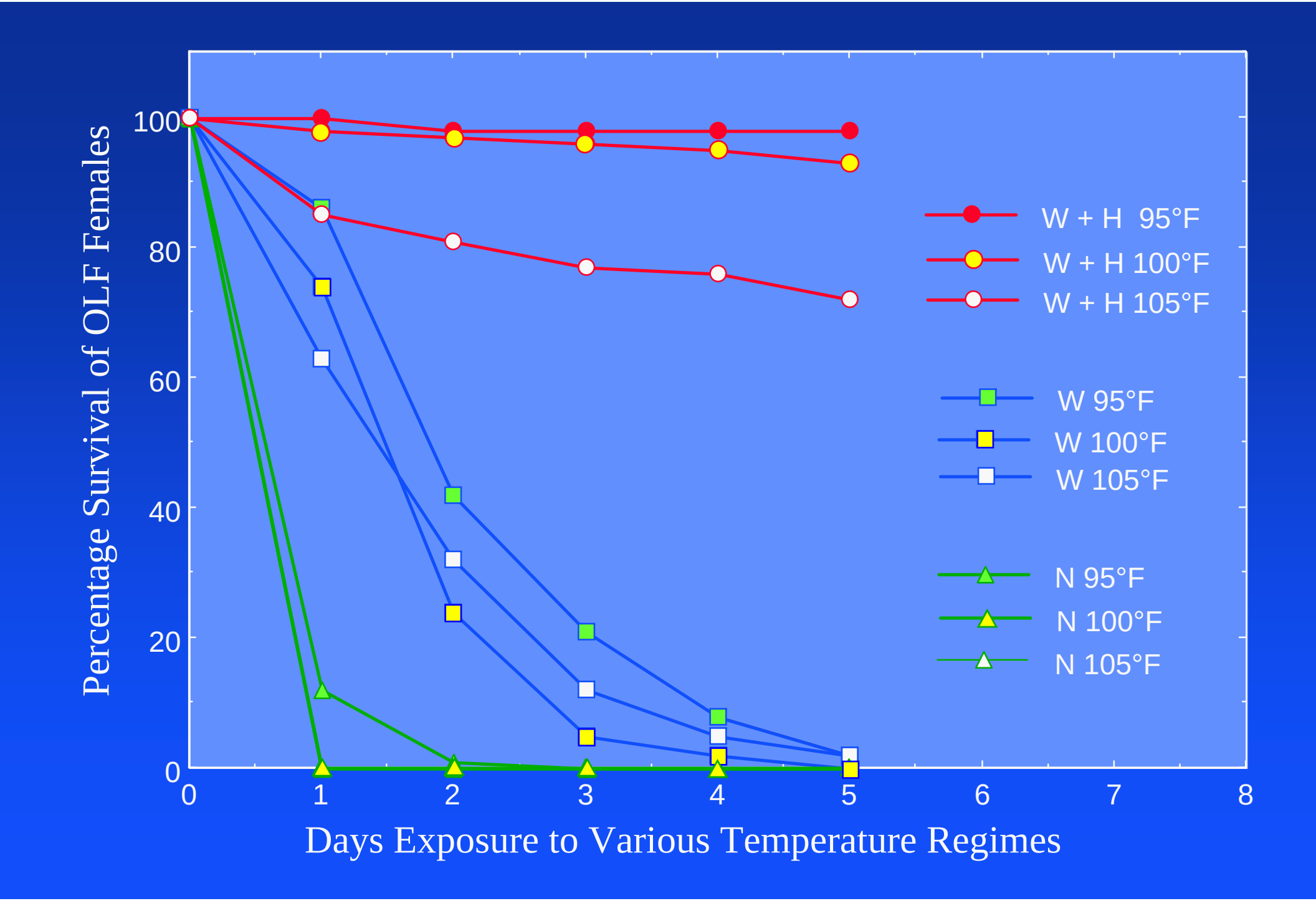
Percentage Survival of OLF Females
100
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8
Days Exposure to Various Temperature Regimes
W + H 95°F
W + H 100°F
W + H 105°F
W 95°F
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N 95°F
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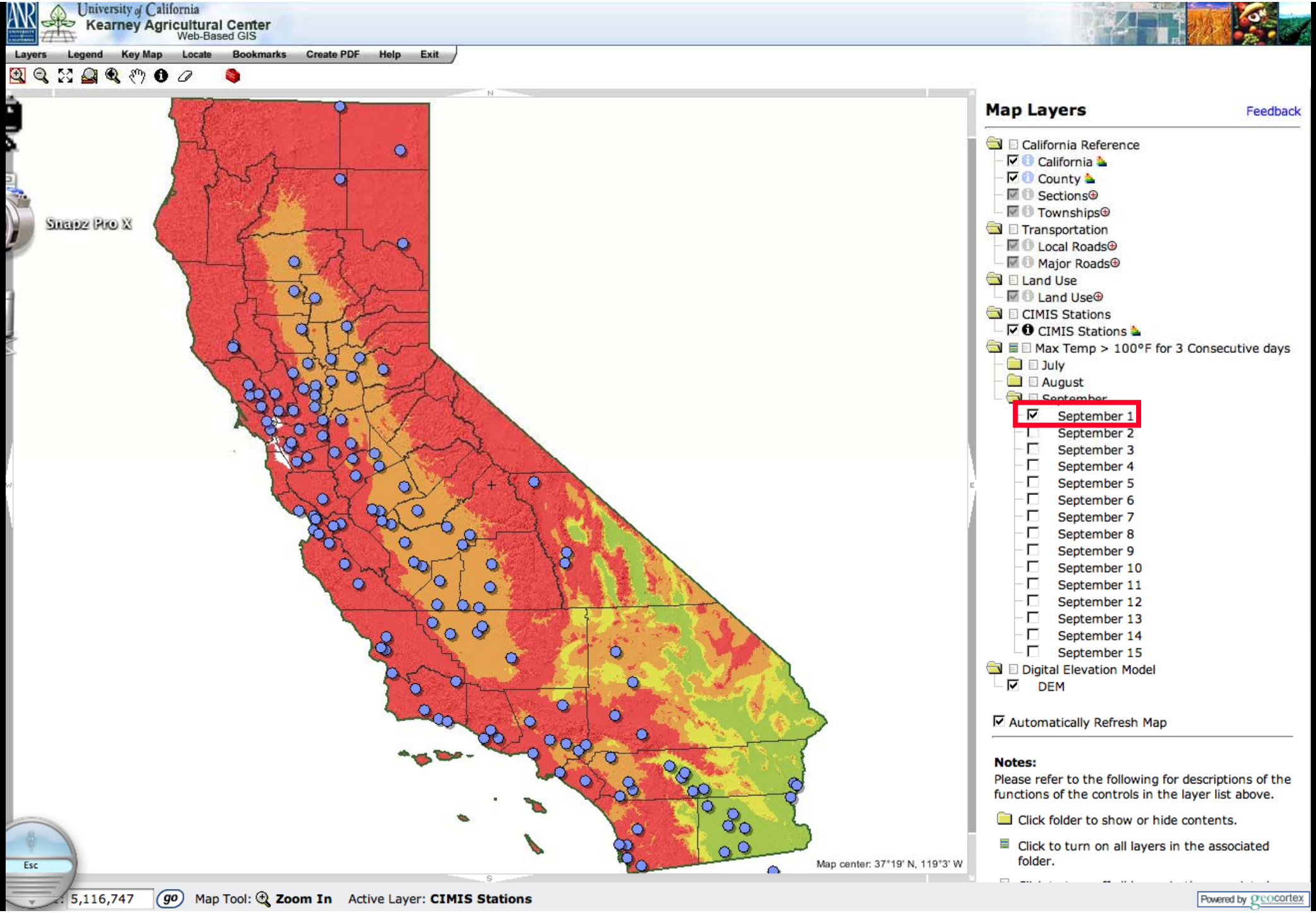
N 105°F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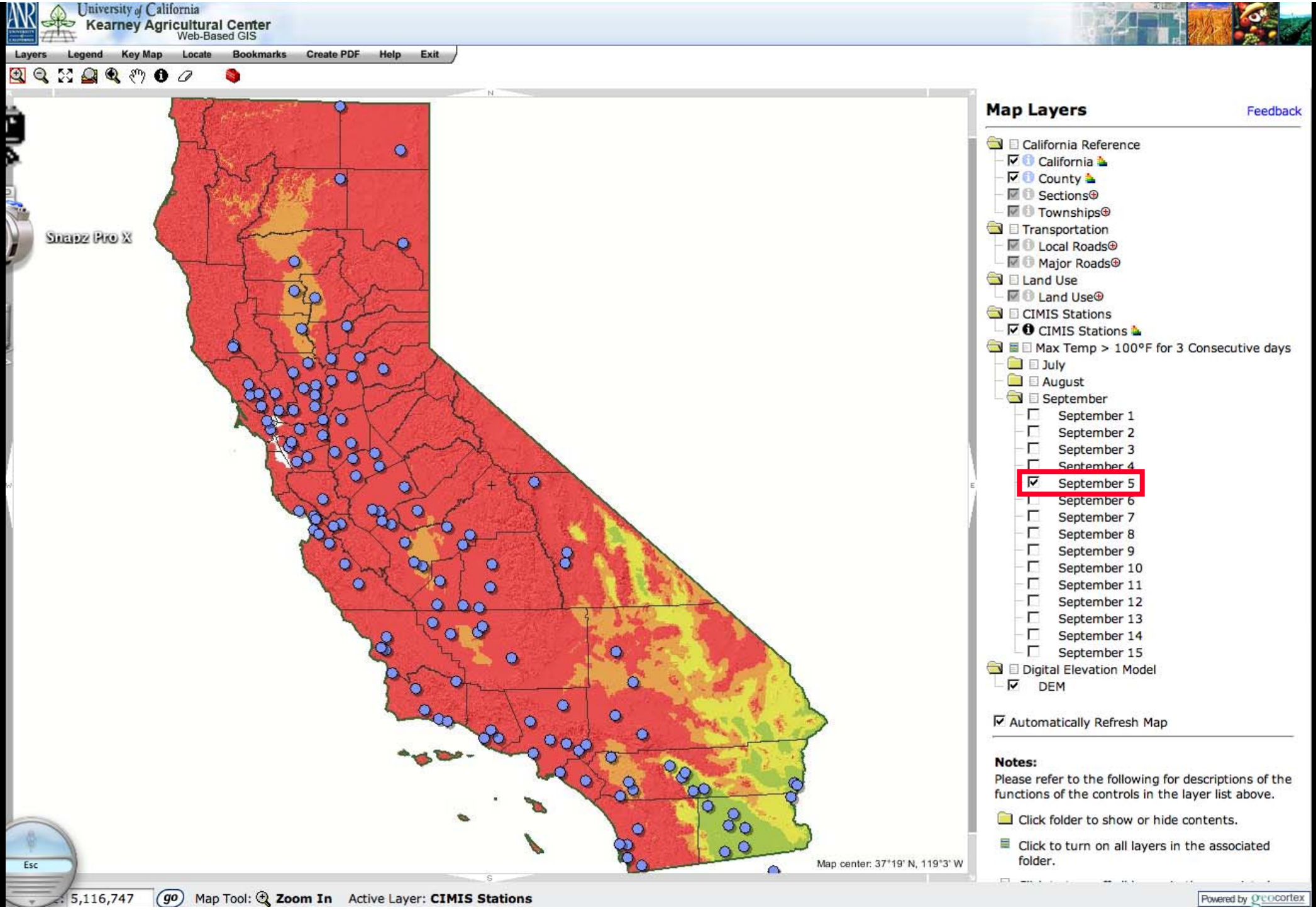
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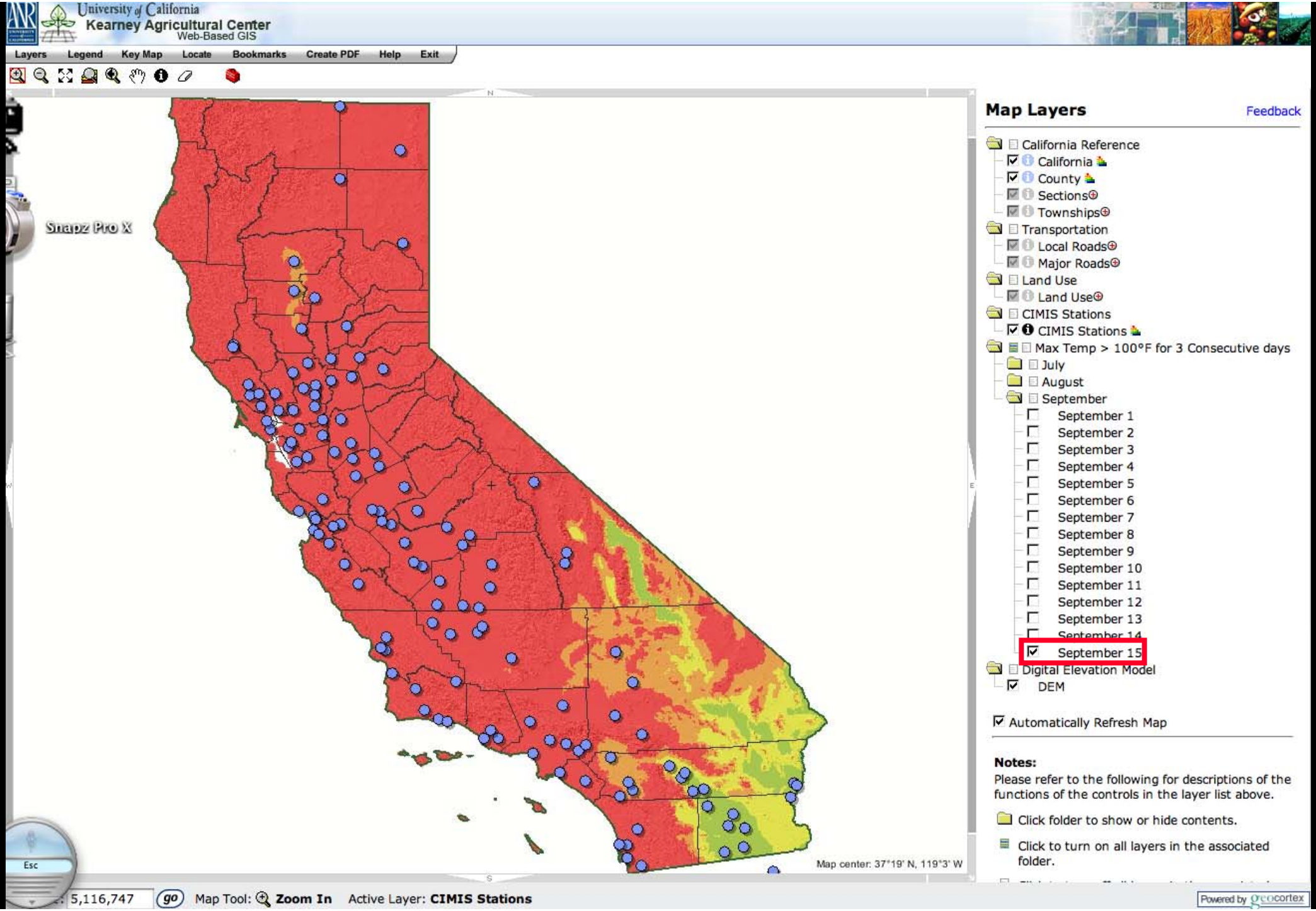
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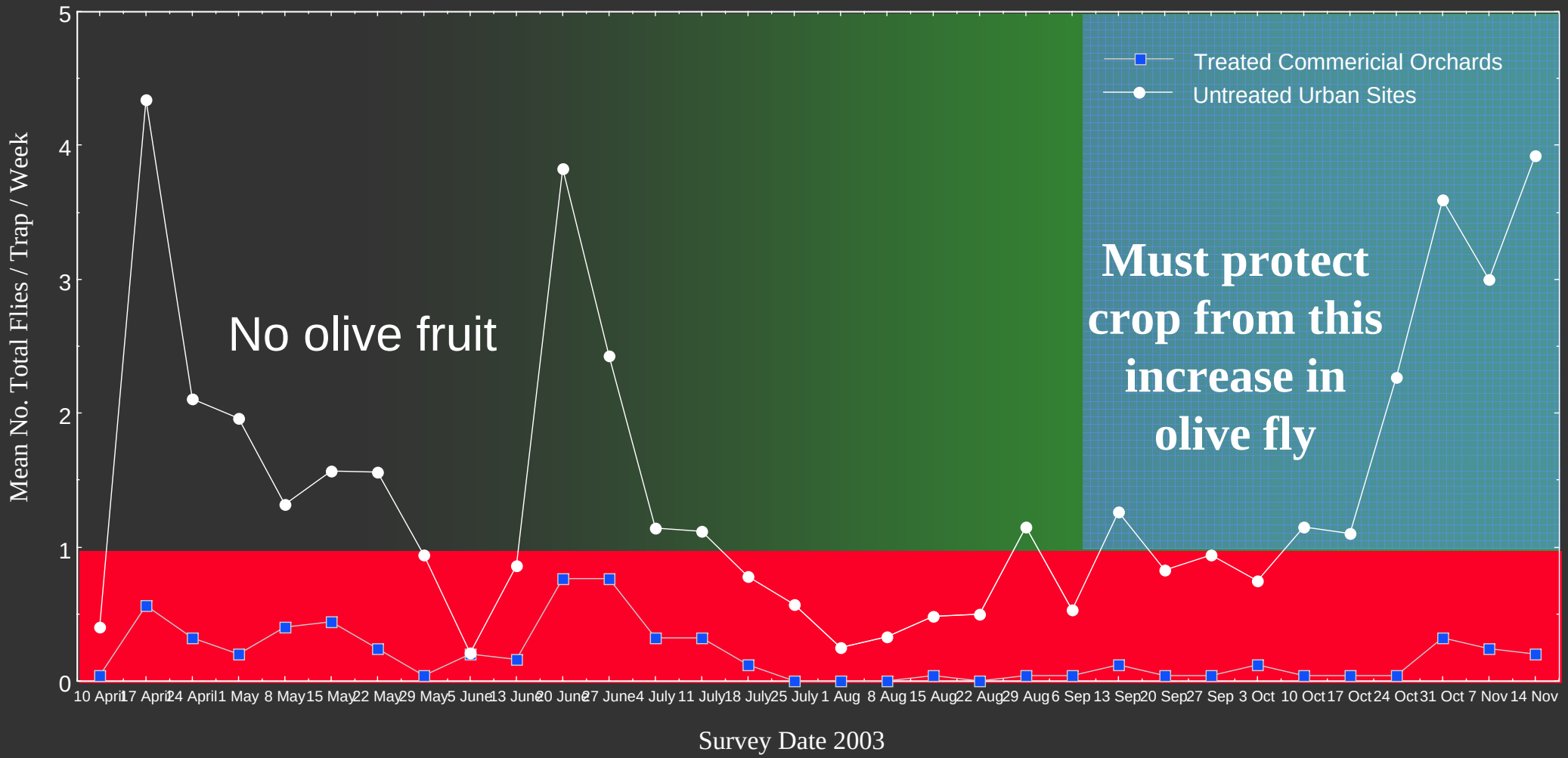
Average Adult Olive Fly Trap Counts in Tulare & Fresno Counties



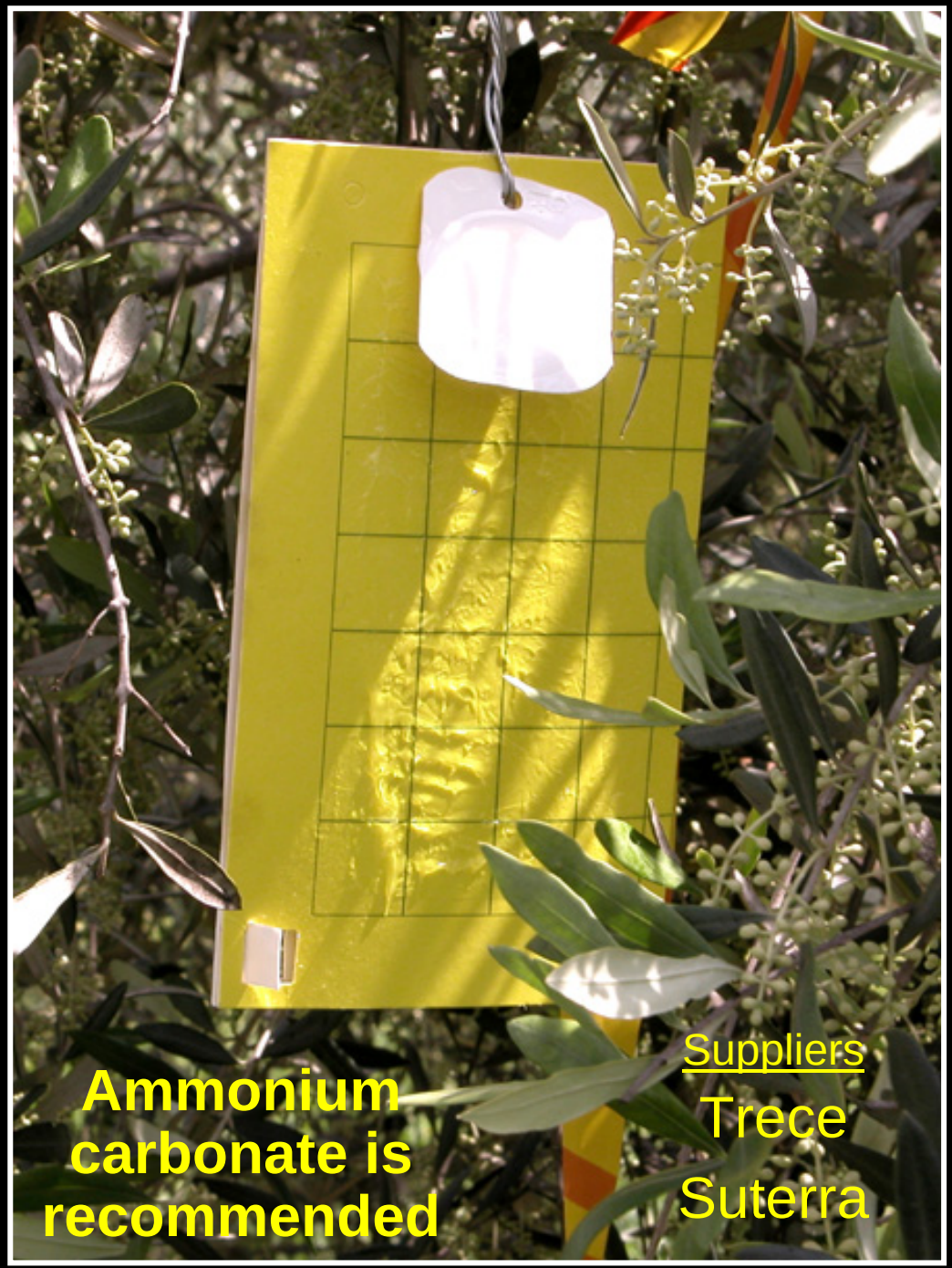
Aerial traps attract adult flies with the help of food & sex lures

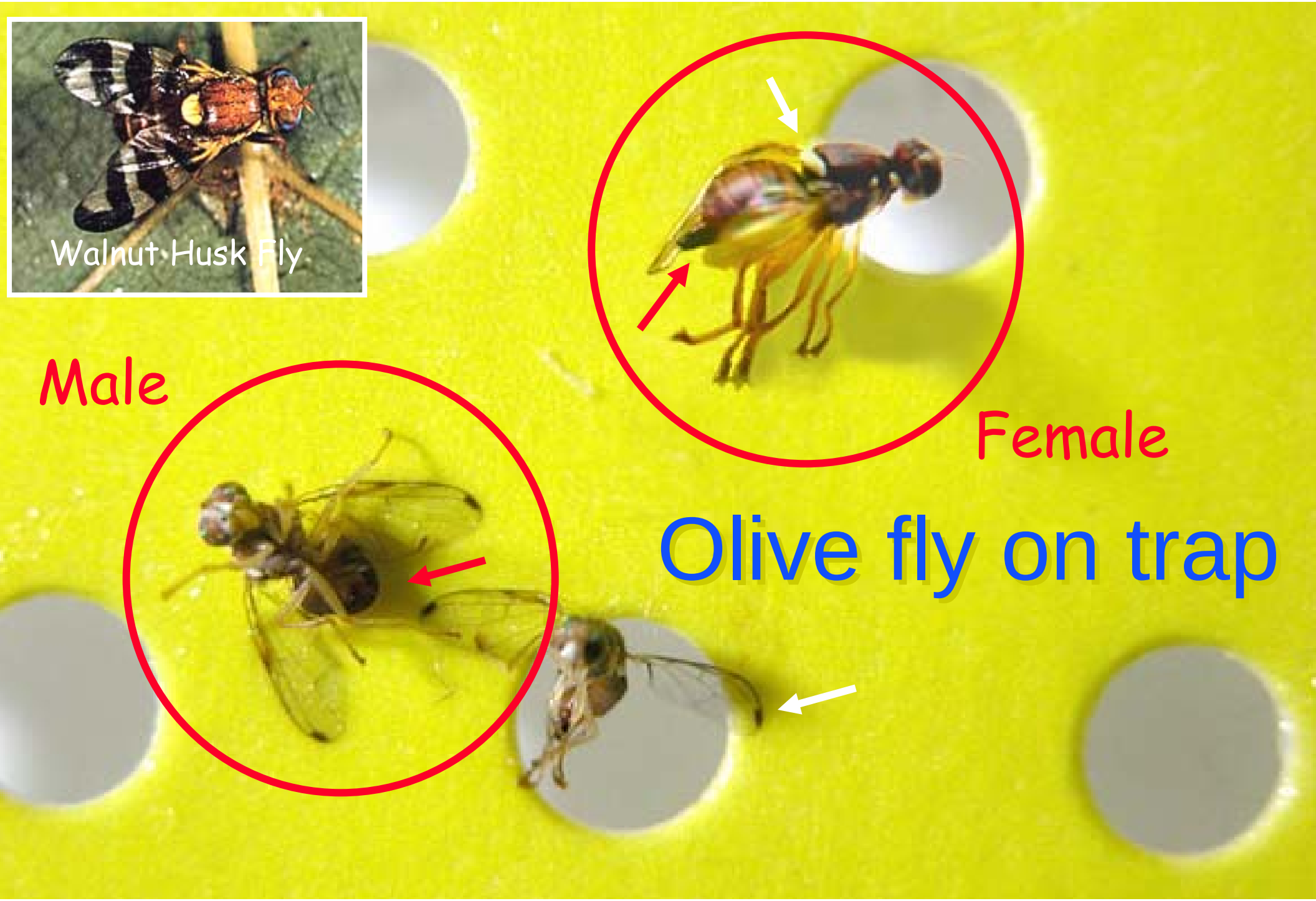
Placement in Trees

- Place on north side of tree in spring / summer
- Place on south side of tree in fall / winter
- Place in upper one third of tree
- Allow clear space around trap
- At least one trap per 5 - 10 acres of olives
- At least 2 traps per olive block; use more if possible
- Traps should be placed in trees no later than March 1

Simple Yellow Panel Trap

- Easy to assemble
- Commercially available




Walnut Husk Fly
Male
Female
Olive fly on trap

McPhail Trap

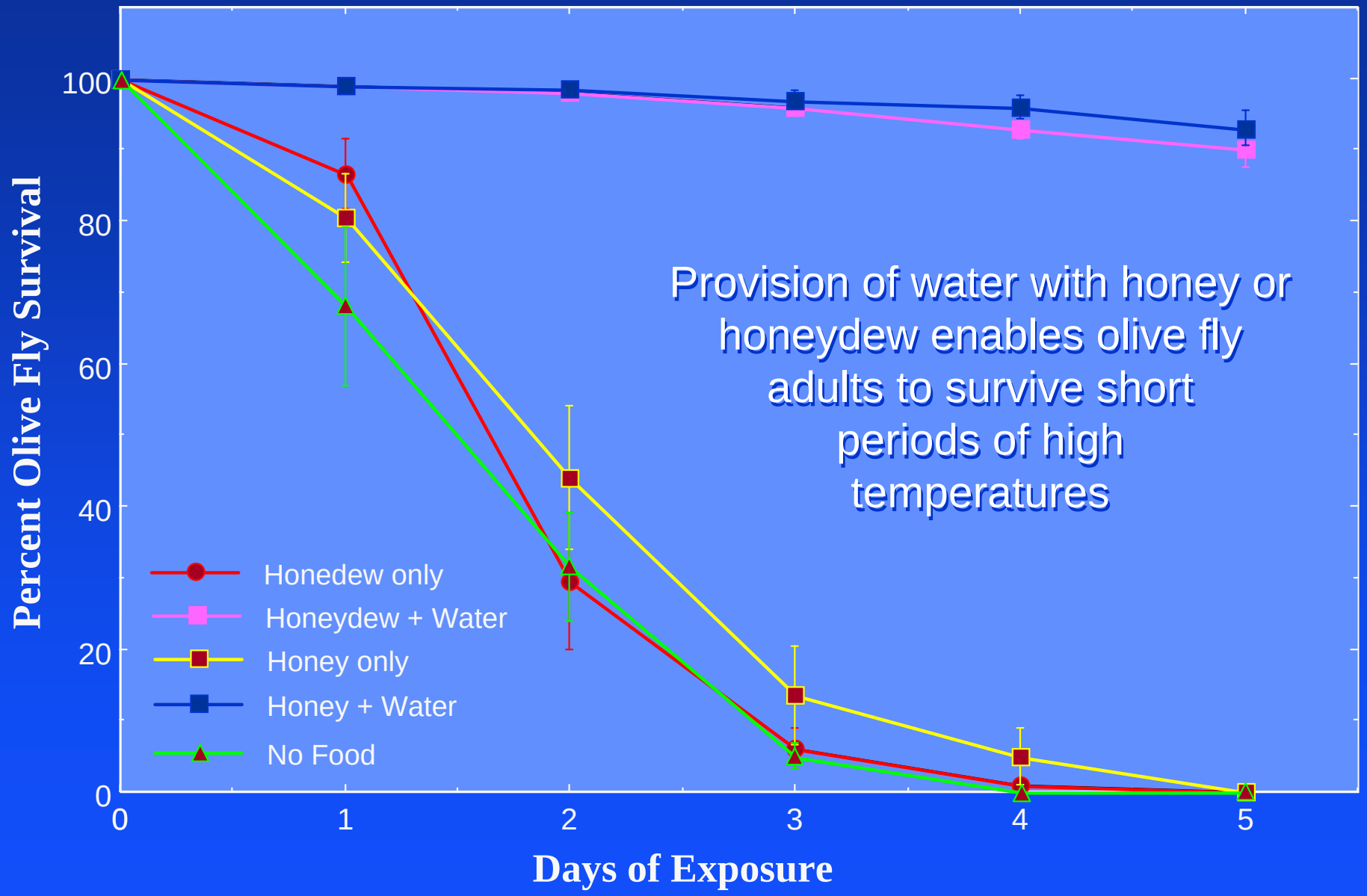
Torula Yeast & Borax

Presentation Topics

- Timing and application of GF-120
- Current management alternatives
- Impact of summer heat on fly numbers
- The need to control black scale
- Biological control efforts underway

- Black scale is common throughout the Central Valley and produces honeydew that flies may potentially use as a carbohydrate source
- Does honeydew consumption enable flies to survive periods of extreme heat?

Laboratory Data: High = 97.5 ºF; Low = 65 ºF



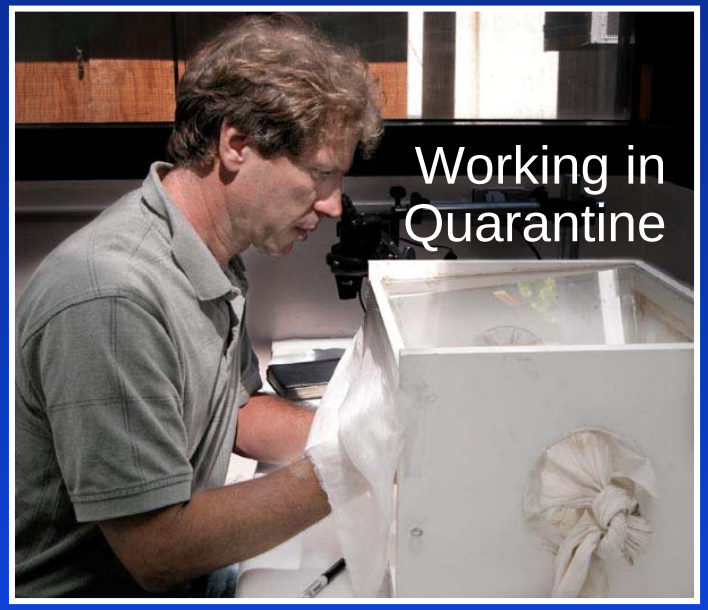
What Factors Potentially Reduce the Impact of Summer Heat on Olive Fly?

- Temperature fluctuations that reduce the numbers of days that daily temperatures equal or surpass a maximum of 100ºF in sequence (e.g., less than 3 days in sequence)
- Presence of nearby water that is readily assessible water to flies (e.g., ponds, canals, creeks, irrigation sources)
- Presence of honeydew within the flight range of the flies
- Large trees with heavy foliage that shade the area
- High densities of weeds within the orchard
- Nearby sources (e.g., abandoned orchards) of olive flies that may re-invade the orchard when temperatures drop

Presentation Topics

- Timing and application of GF-120
- Current management alternatives
- Impact of summer heat on fly numbers
- The need to control black scale
- Biological control efforts underway

Potential for control using biocontrol agents



Biocontrol Agents Under Consideration for Release

Summary

- GF-120 is the only insecticide that is registered to control olive fruit fly adults
- Depending on the size of the olive fly population, the ratios of GF-120 and water should be varied to obtain the best control
- An understanding of the impact of extreme summer temperatures is necessary to avoid unnecessary losses due to olive fly infestations
- A website at the UC Kearney Agricultural Center is available to help estimate the possible influences of summer heat on olive fly survival
- Control of black scale may reduce survival of olive fly adults due to removal of a potential food source
- Biological control is poor at this time, but new exotic natural enemies are being released to improve levels of biological control


Questions?