

# Mountain lion studies update

Winston Vickers / Walter Boyce  
UC Davis Wildlife Health Center

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# Previous studies

- Survival = low – 56% mean annual (MARK)
- Mortality causes = Vehicles, depredation permits over half, increased risk on unconserved lands
- 
- Genetics = Serious restriction / inbreeding
- Habitat Use and Movement = Narrow linkage across I-15, many highway crossings increase risk

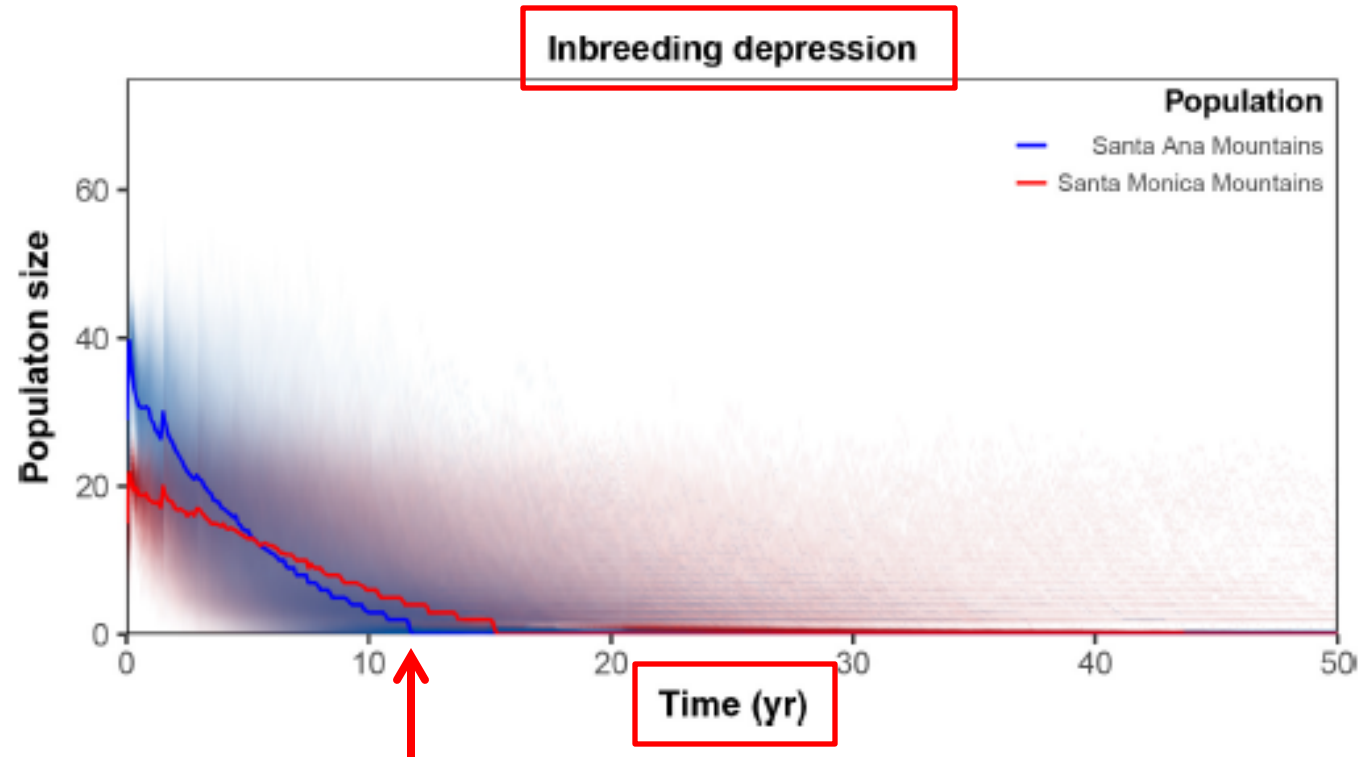


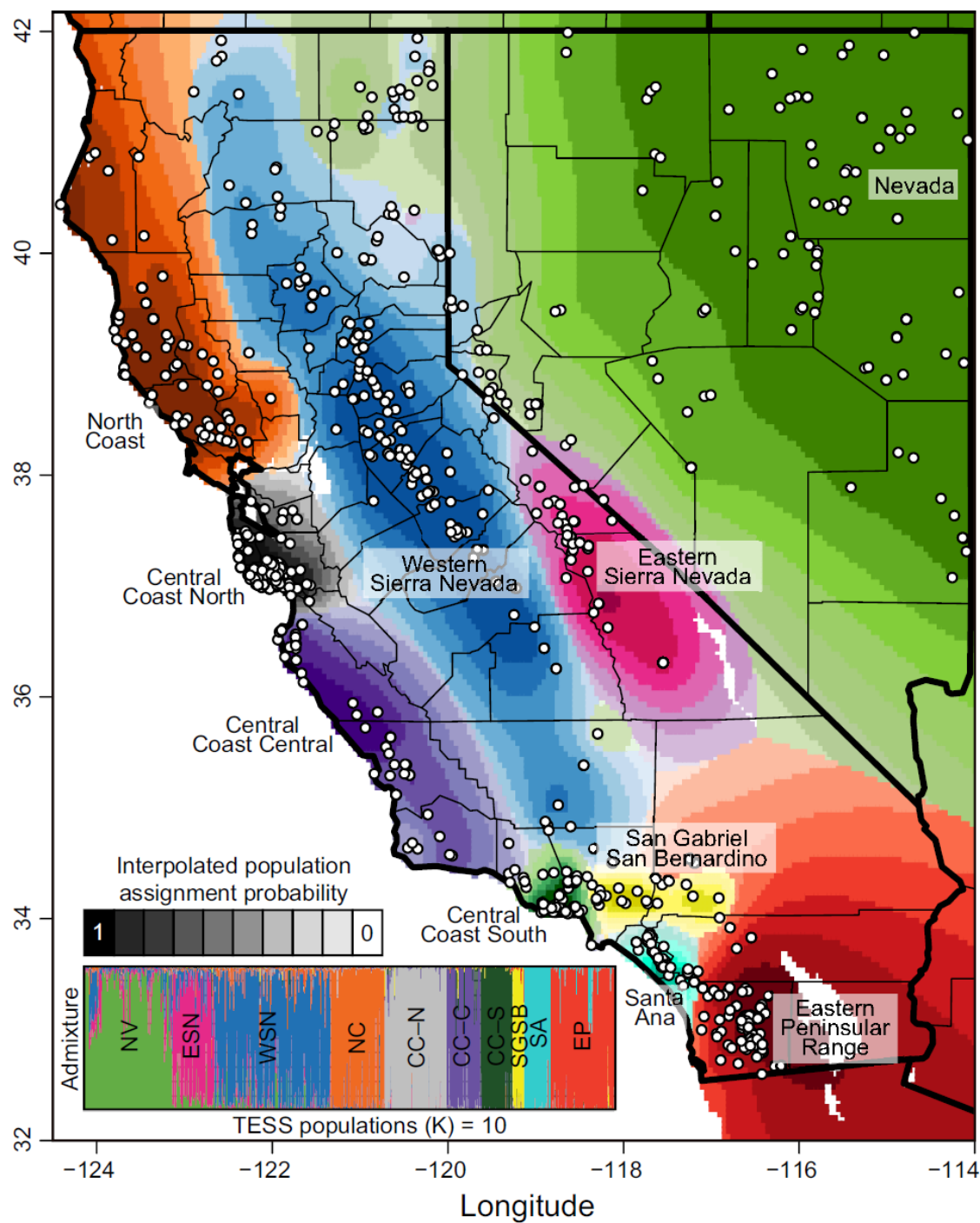
FIG. 4. Density-dependent demographic projections from individual-based population model showing predicted population sizes for mountain lions in the Santa Ana and Santa Monica Mountains over 50 yr based on 5,000 projections when we simulated inbreeding depression with the observed level of immigration.

Evidence is accumulating of possible inbreeding depression effects in Santa Monicas and Santa Anas – low sample sizes so far.



CESA petition  
for listing 6  
subpopulations  
as Threatened  
in CDFW review

From Gustafson  
et al. 2018



# Known Mortalities Santa Anas and E Peninsulars – 2020-21

- Vehicle - 4
- Depredation - 3
- Disease – Leptospirosis – 2
- Unknown - 2
- Another lion – 1
- Public Safety – 1
- Fire – 1 – (F121 - only confirmed remaining offspring of M86)
- Also 40 pound male hit by car on 241 at Los Alisos but not killed – recovering and staying in captivity

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M86 - 11 offspring – enhanced diversity  
M86 and over half of offspring known deceased



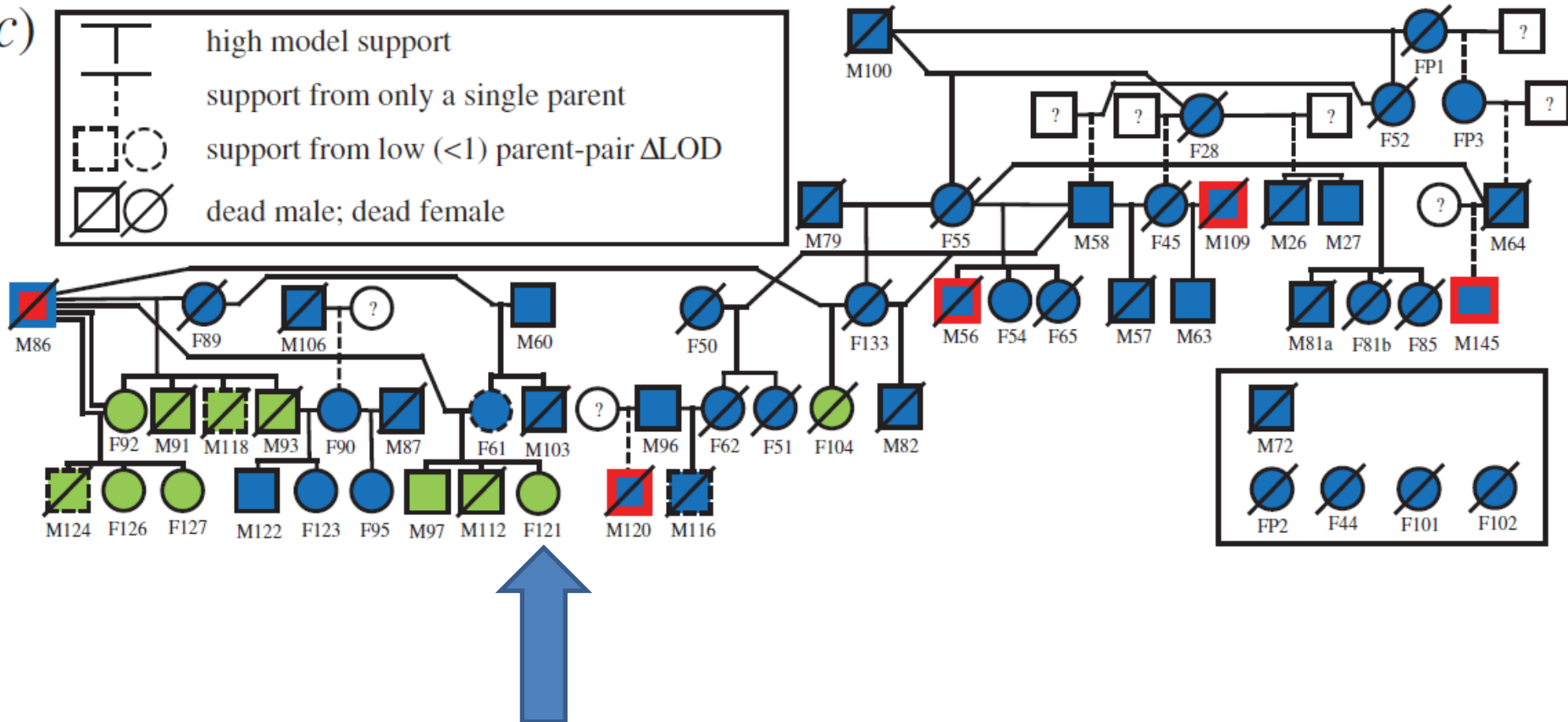
Photo Credit: Irvine Ranch Conservancy



# Santa Ana Range

(c)

migrants











30 °C / 86 °F

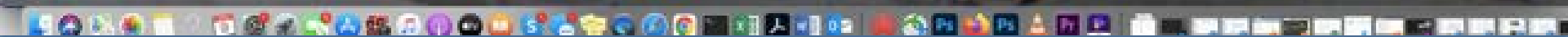
2020/10/27 16:22:25



20 °C / 68 °F

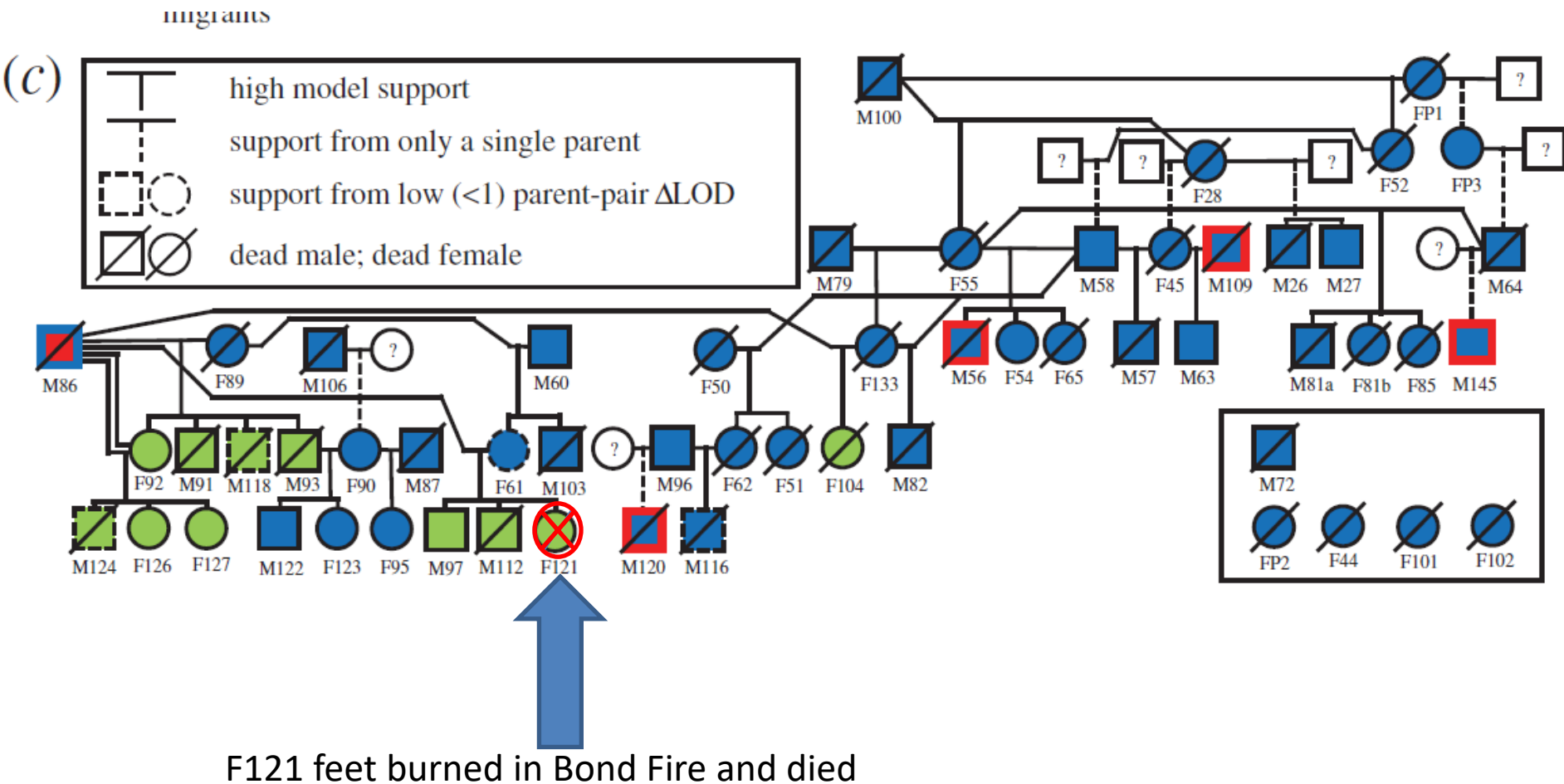
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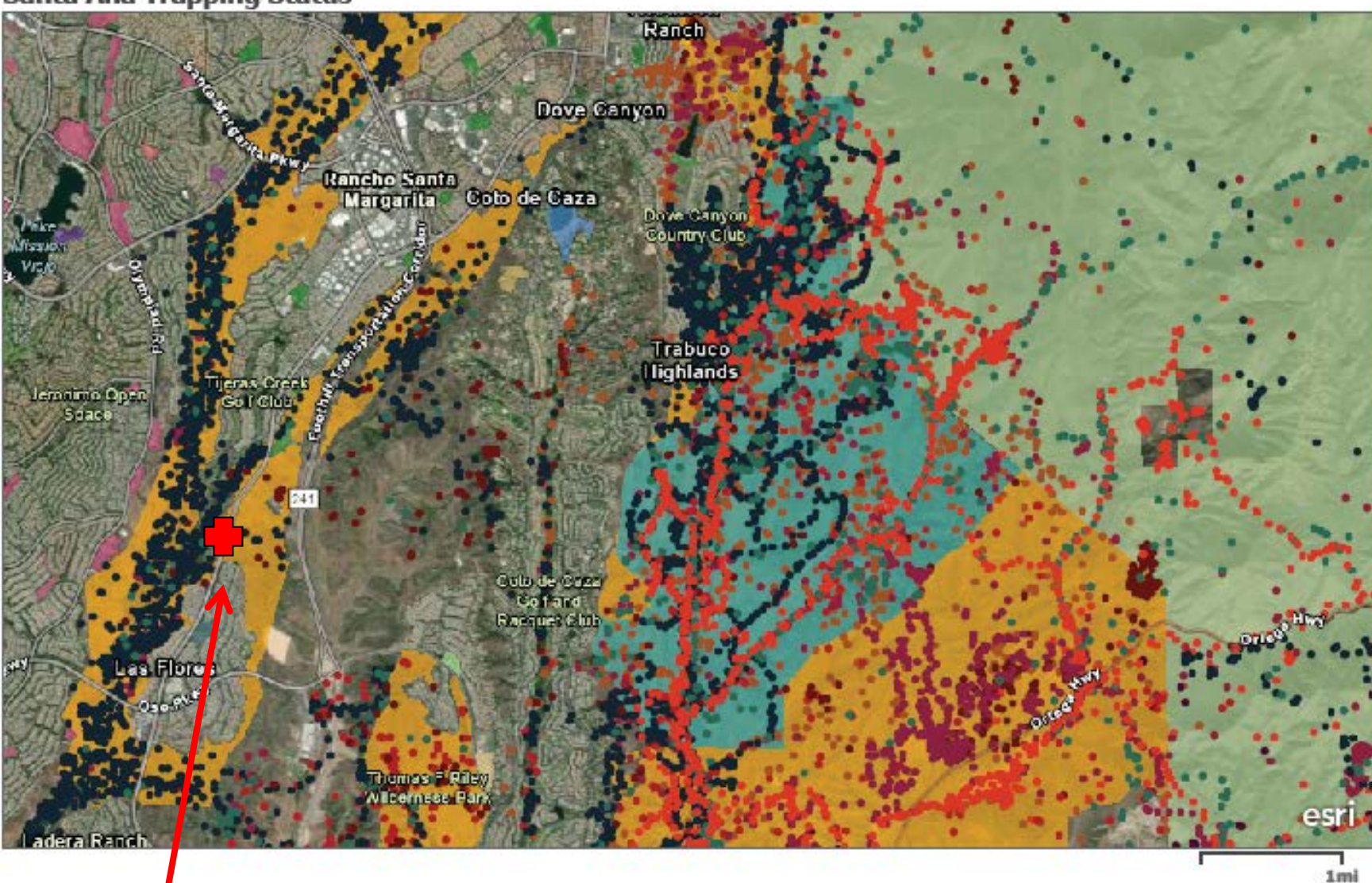
UPS





# Santa Ana Range



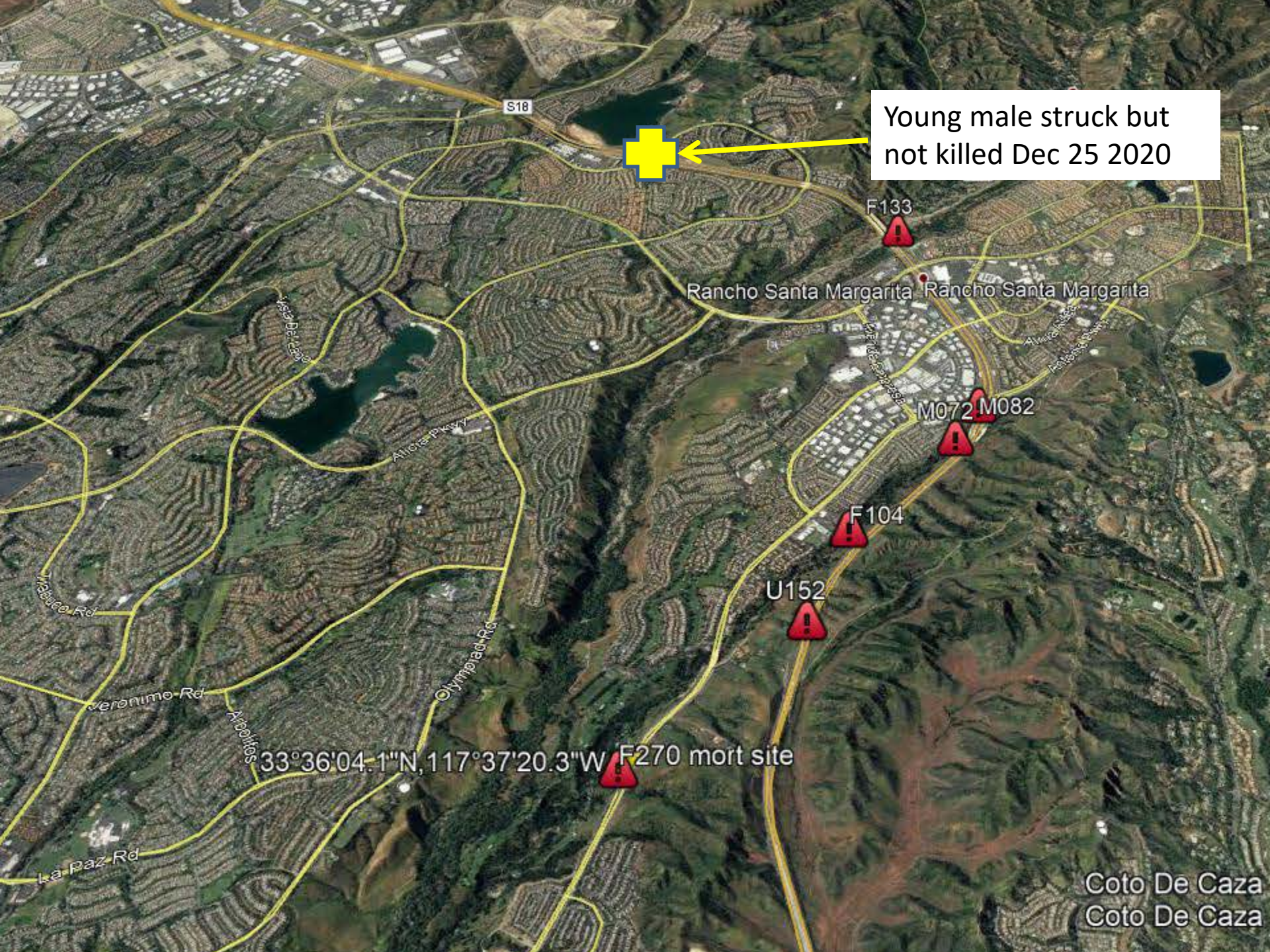


Zeller KA, Vickers TW, Ernest HB, Boyce WM (2017) Multi-level, multi-scale resource selection functions and resistance surfaces for conservation planning: Pumas as a case study. PLoS ONE 12(6): e0179570. | Jeff Manning, Assistant Professor, Washington State University (jeff.manning@wsu.edu) (Co-PI and author) and T. Winston Vickers, DVM, University of California, Davis (twvickers@ucdavis.edu) (PI). | Earthstar Geographics | County of Riverside, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, US Census Bureau, USDA

F270 mort site – 1/25/21

Development patterns lead to pumas crossing roads and streets and close to development





Young male struck but not killed Dec 25 2020

F133

Rancho Santa Margarita Rancho Santa Margarita

M072 M082

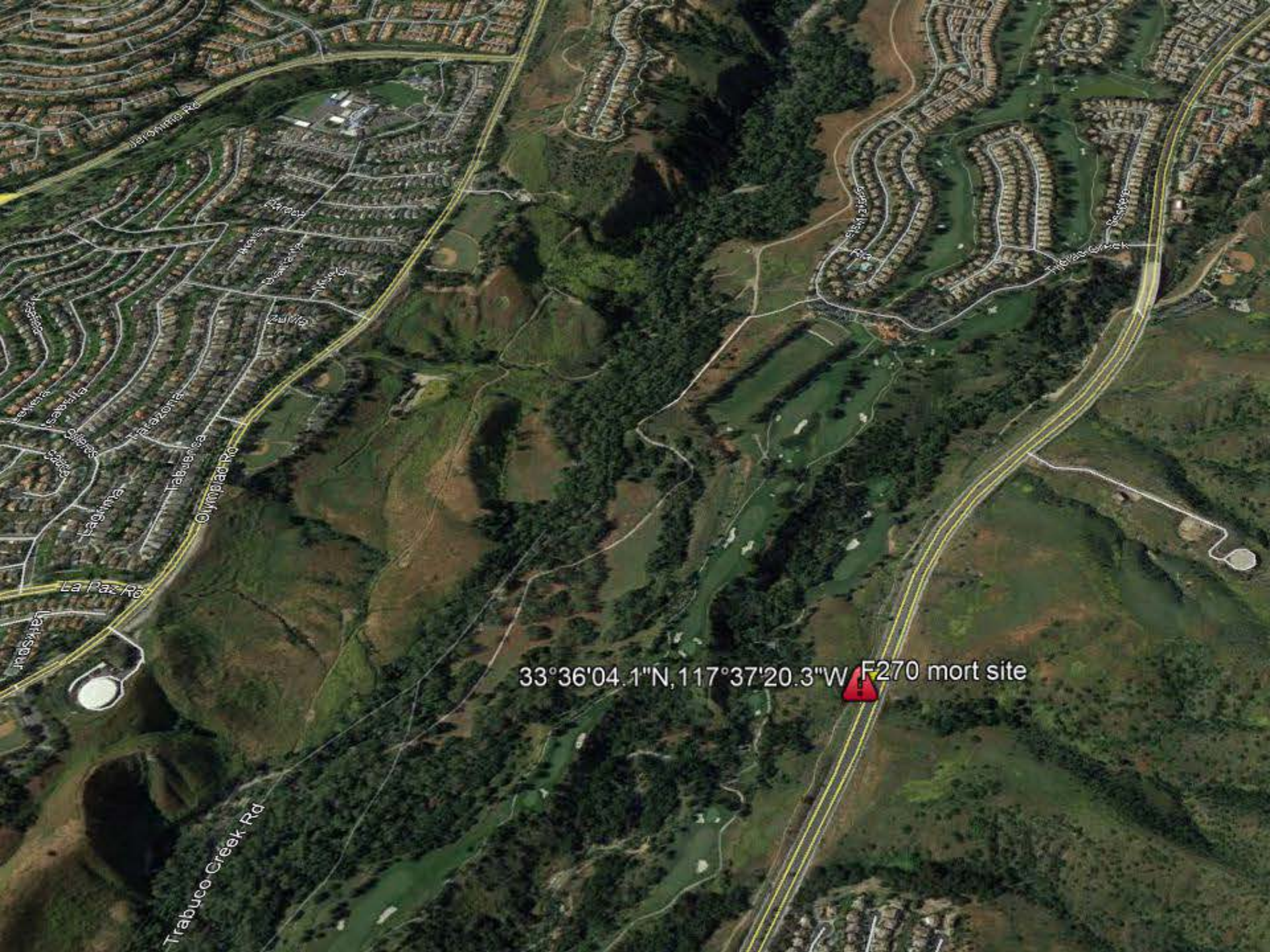
F104

U152

33°36'04.1"N, 117°37'20.3"W F270 mort site

Coto De Caza  
Coto De Caza





33°36'04.1"N, 117°37'20.3"W F270 mort site





33°36'04.1"N, 117°37'20.3"W F270 mort site

Pkwy





Golf course and creek

Ravine travelway meeting roadway  
Fencing minimal

F270 – Killed 1/25/21  
Antonio Parkway



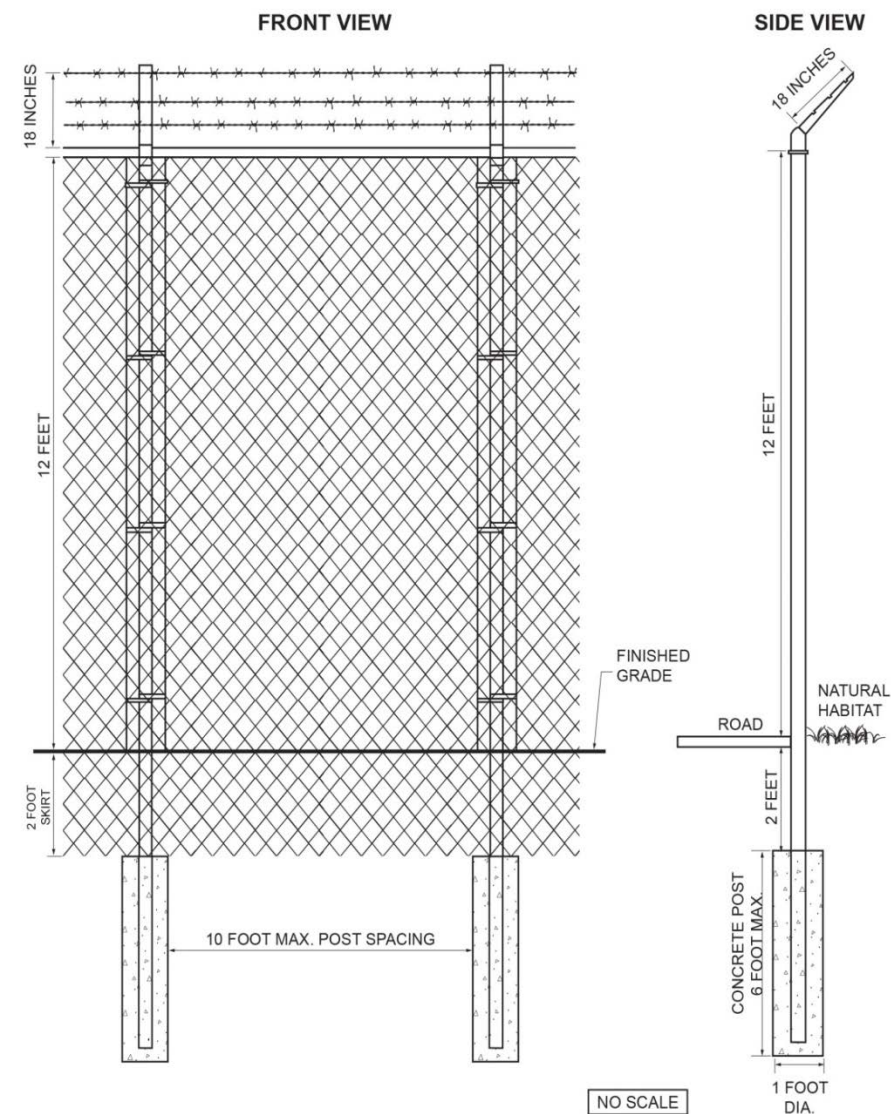
# How Effective Is Road Mitigation at Reducing Road-Kill? A Meta-Analysis Rytwinski et al. 2016

- Underpasses alone did not reduce roadkill
- Fencing alone (if long enough) was moderately effective for large mammals but connectivity issue
- Fencing with crossing structures was more effective if fence long enough, but fencing tended to be shorter and overall less effective – so fence length very important
- Fence-end effects were not well tracked



# SR 241 FENCING PROJECT

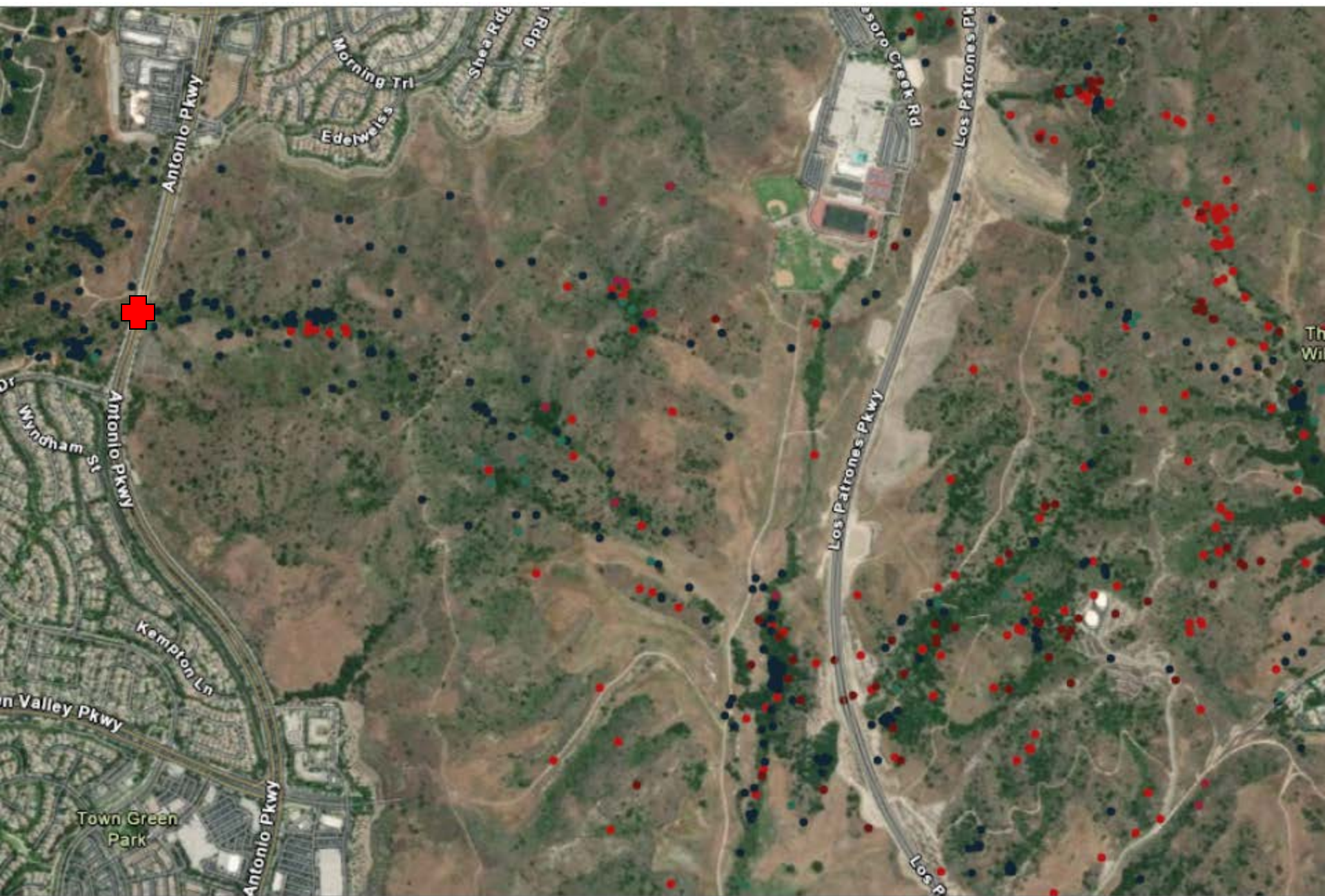
(100% REDUCTION IN MORTALITY – DEER, BOBCAT, MT. LION,  
AND OVER 95% FOR COYOTES)





8 ft farm fence with outriggers and jumpouts – no mt lion mortalities to date









**I-15 Wildlife Exclusion Fence Project  
8 ft chain link with jumpouts and  
outriggers**



# Hwy 76 project

- 8 ft chain link and crossing structures
- Roadkill reduced in areas with fencing
- Entry roads are a challenge
- Crossing structures are being used

# Current collaring study in SD Co with CDFW

- Collared 9 pumas early 2020 in SD Co, 2 in San Bernardinos/San Gabriels
- In SD Co. - 5 now deceased, 1 unknown (collar malfunction), 3 circulating generally in the Cuyumacas, Volcans, SFV
- In San Bernardinos – 1 deceased, 1 circulating east-west, both crossed I-15 but not I-10

# Scat dog study - CDFW

- Scat dogs run in December - ~200 samples
- 12 sites statewide with collared pumas
- Detectability, confirming RSF, and effective population/min population size are goals
- Will target San Gabriels/San Bernardinos next due to scarcity of genetic data there
- CDFW funding shortfall so not Santa Anas yet

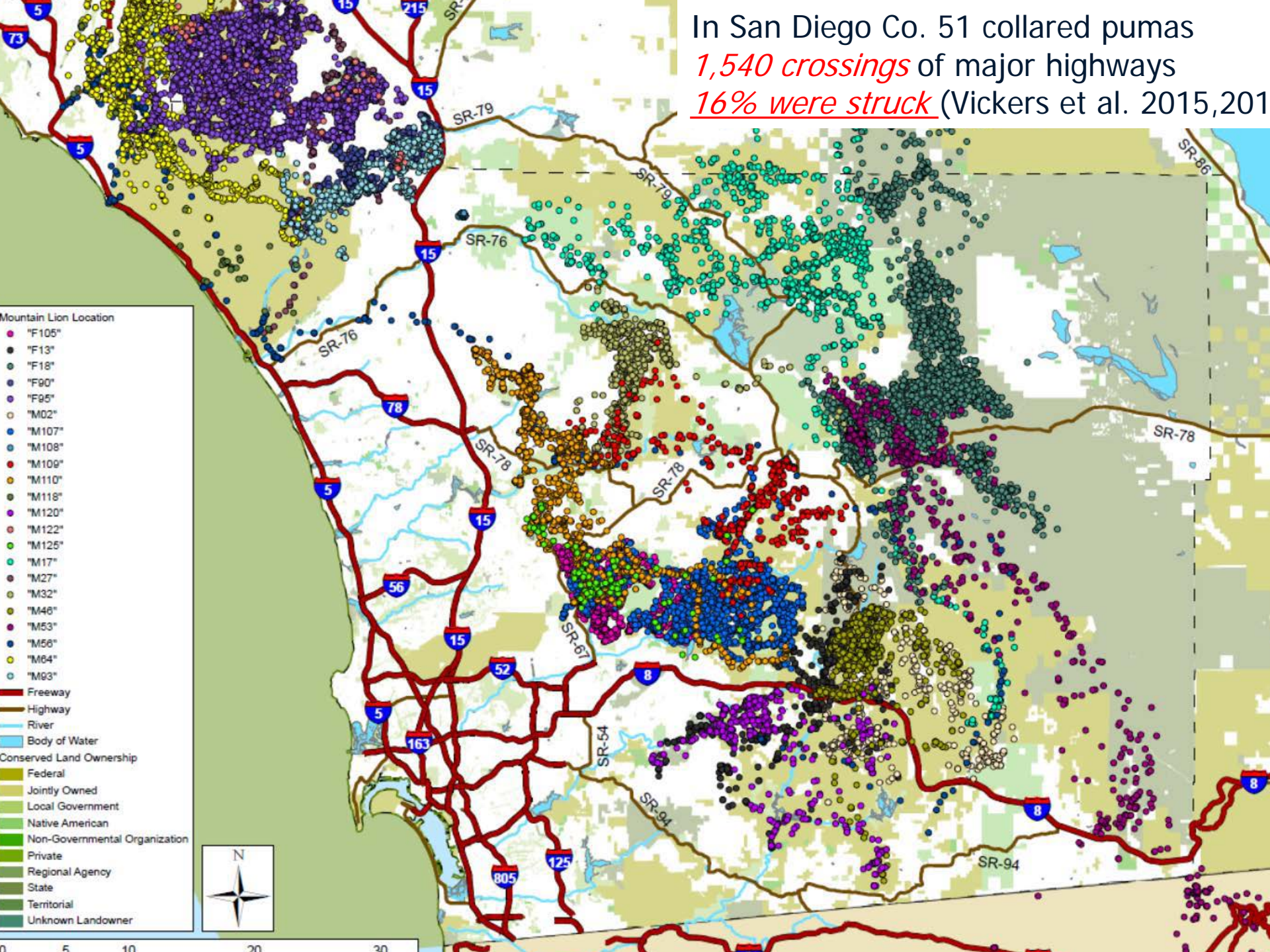


# Completed 2020

- Highway crossing point assessments and prioritization for improvements
- I-15 crossing crossing improvement and design study with Cal Poly Pomona



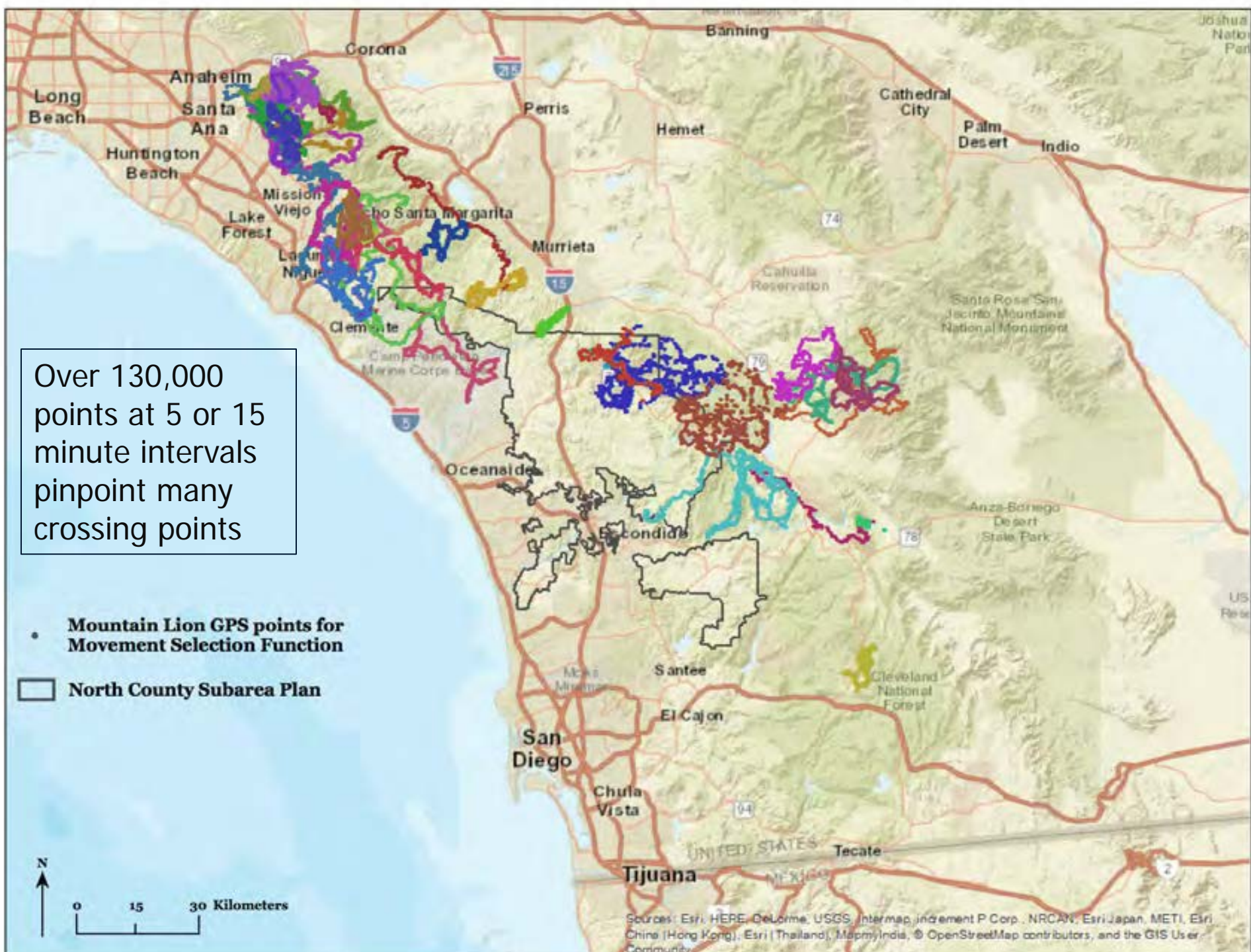
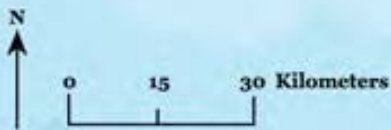
In San Diego Co. 51 collared pumas  
*1,540 crossings* of major highways  
*16% were struck* (Vickers et al. 2015, 201





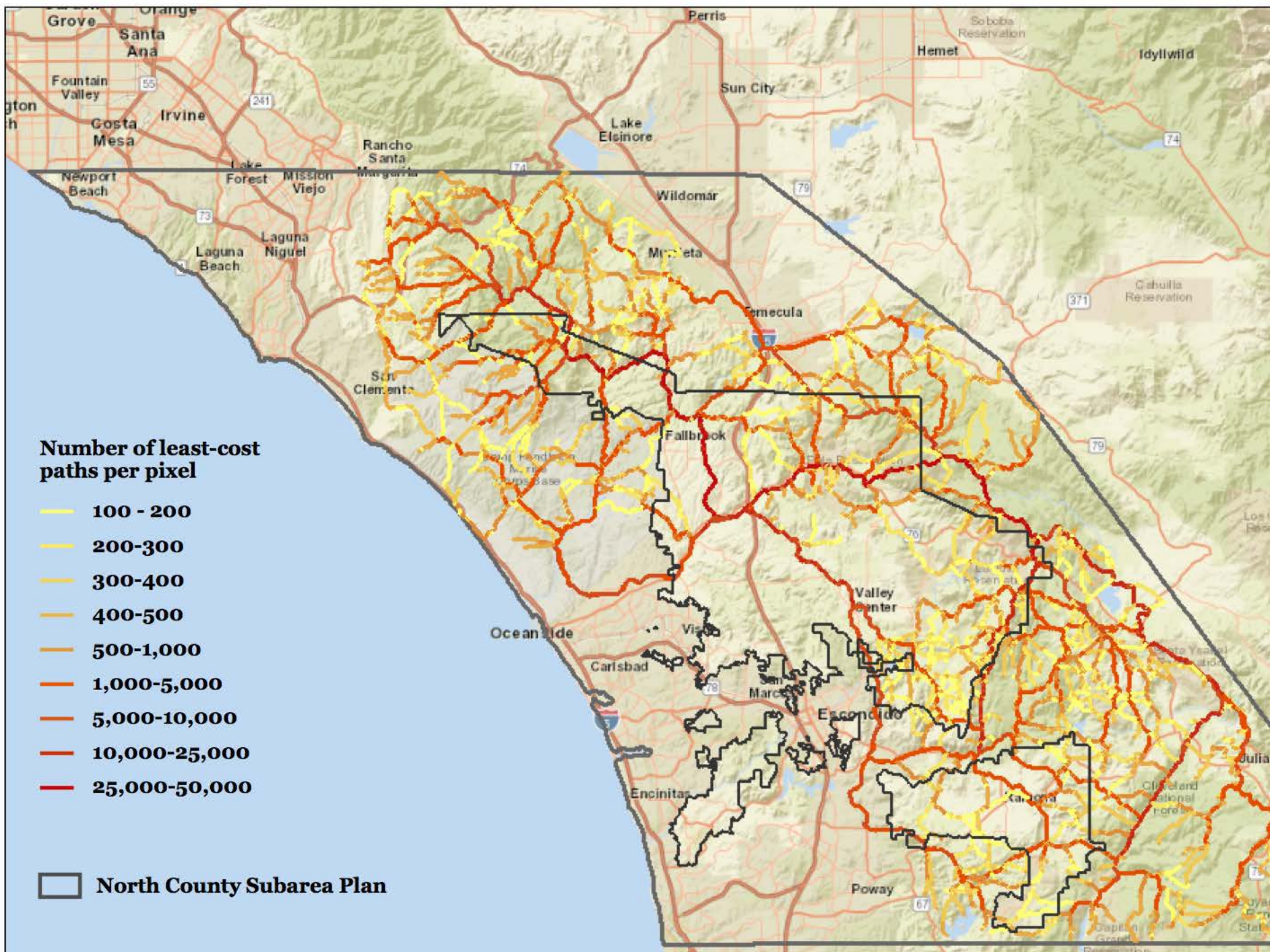
Over 130,000 points at 5 or 15 minute intervals pinpoint many crossing points

- Mountain Lion GPS points for Movement Selection Function
- North County Subarea Plan



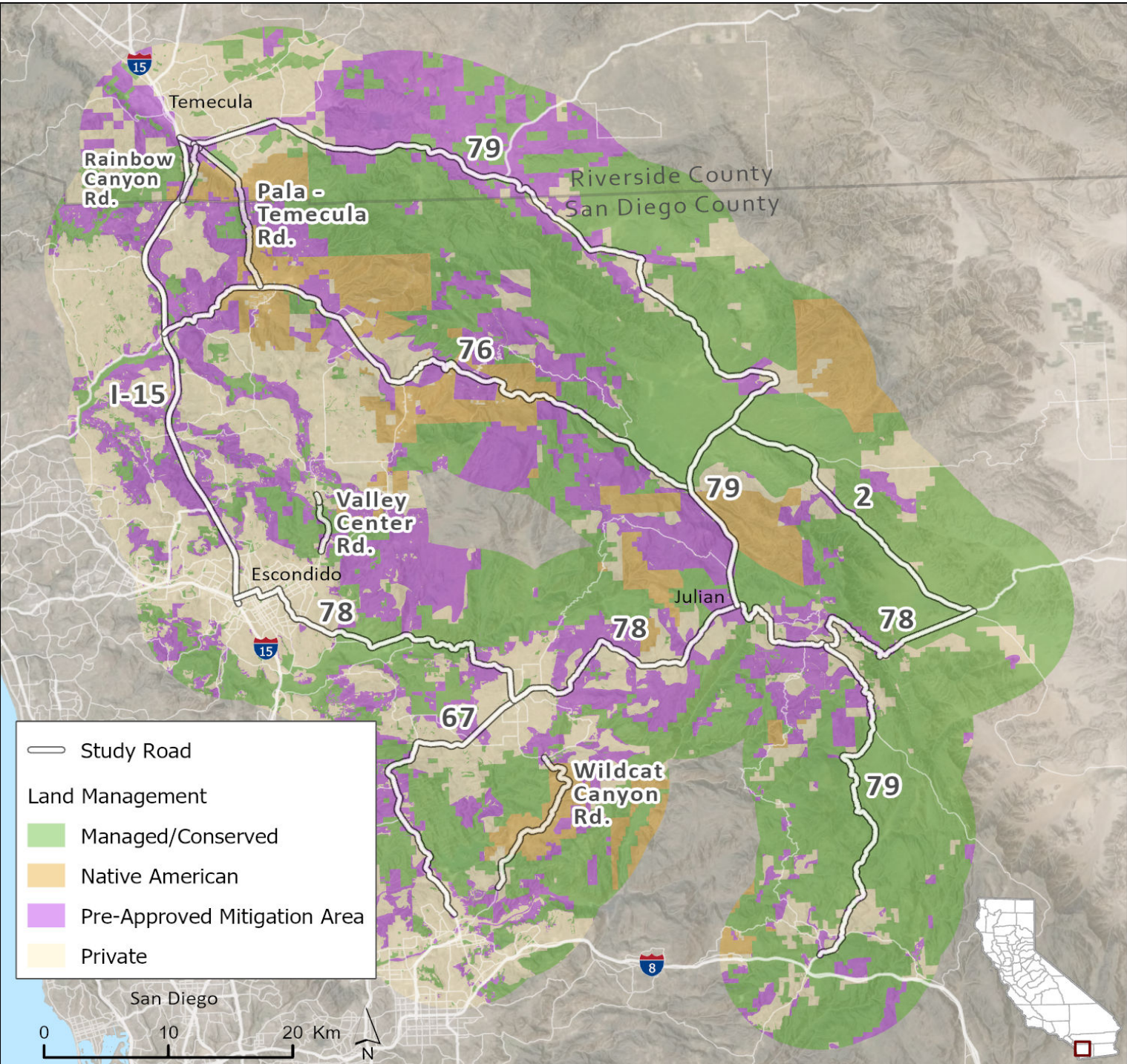
Sources: Esri, HERE, DeLorme, USGS, Intermap, independent P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), MapmyIndia, © OpenStreetMap contributors, and the GIS User Community







Project study area with 5 mile buffers around the highways that are focus of the study.



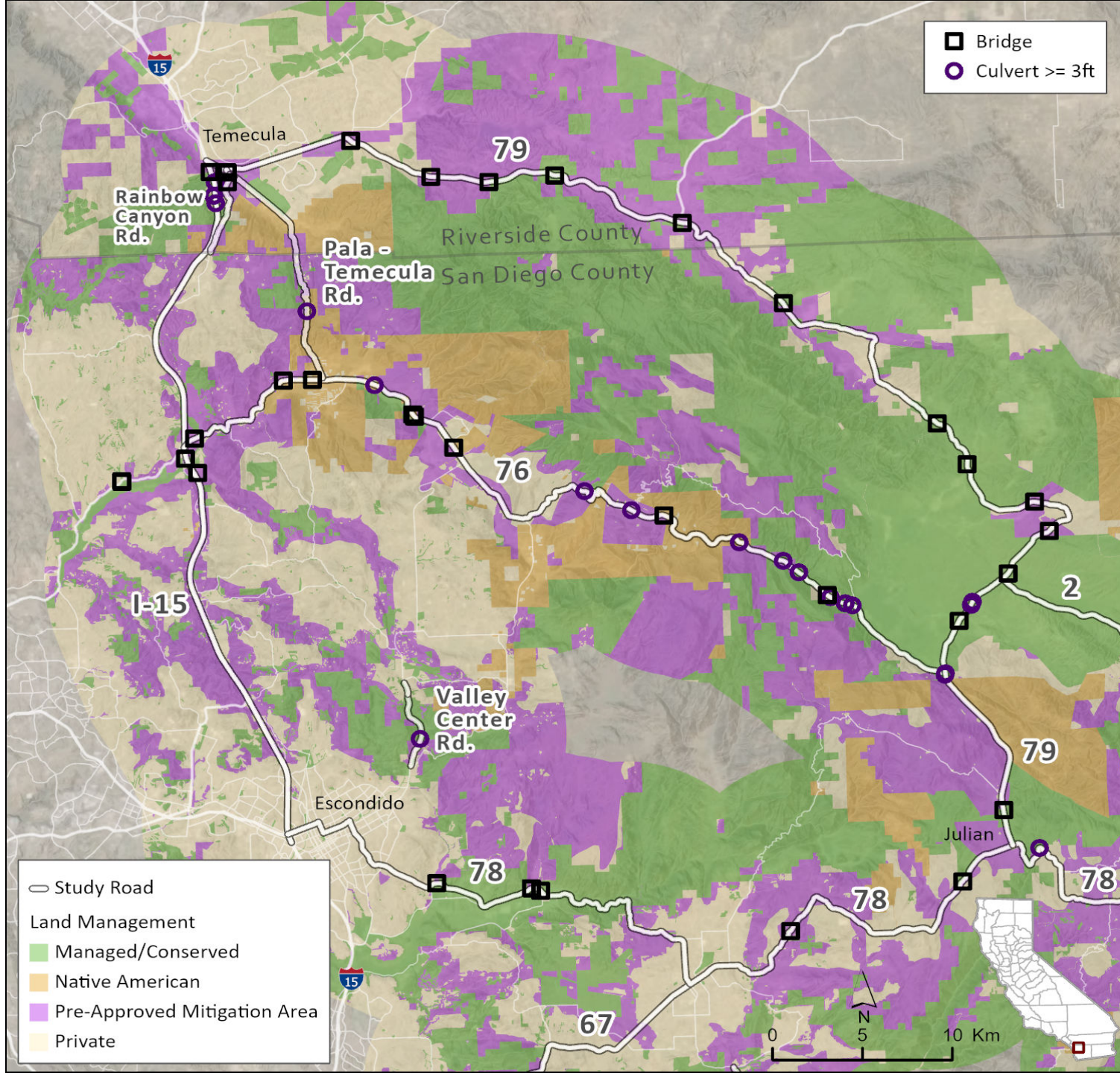
- Known successful crossings from cameras, or 5 to 15 minute frequency collar data (over 130,000 datapoints) – (over half on SR76)
- Unsuccessful crossing attempts (Roadkill –  $n = 13$  lions)
- Zeller least cost path modeling, previous modeling
- Sites named in Missing Linkages Report/expert opinion/other – ( $n=13$ )
- A few sites were too dangerous to access due to traffic and landscape factors



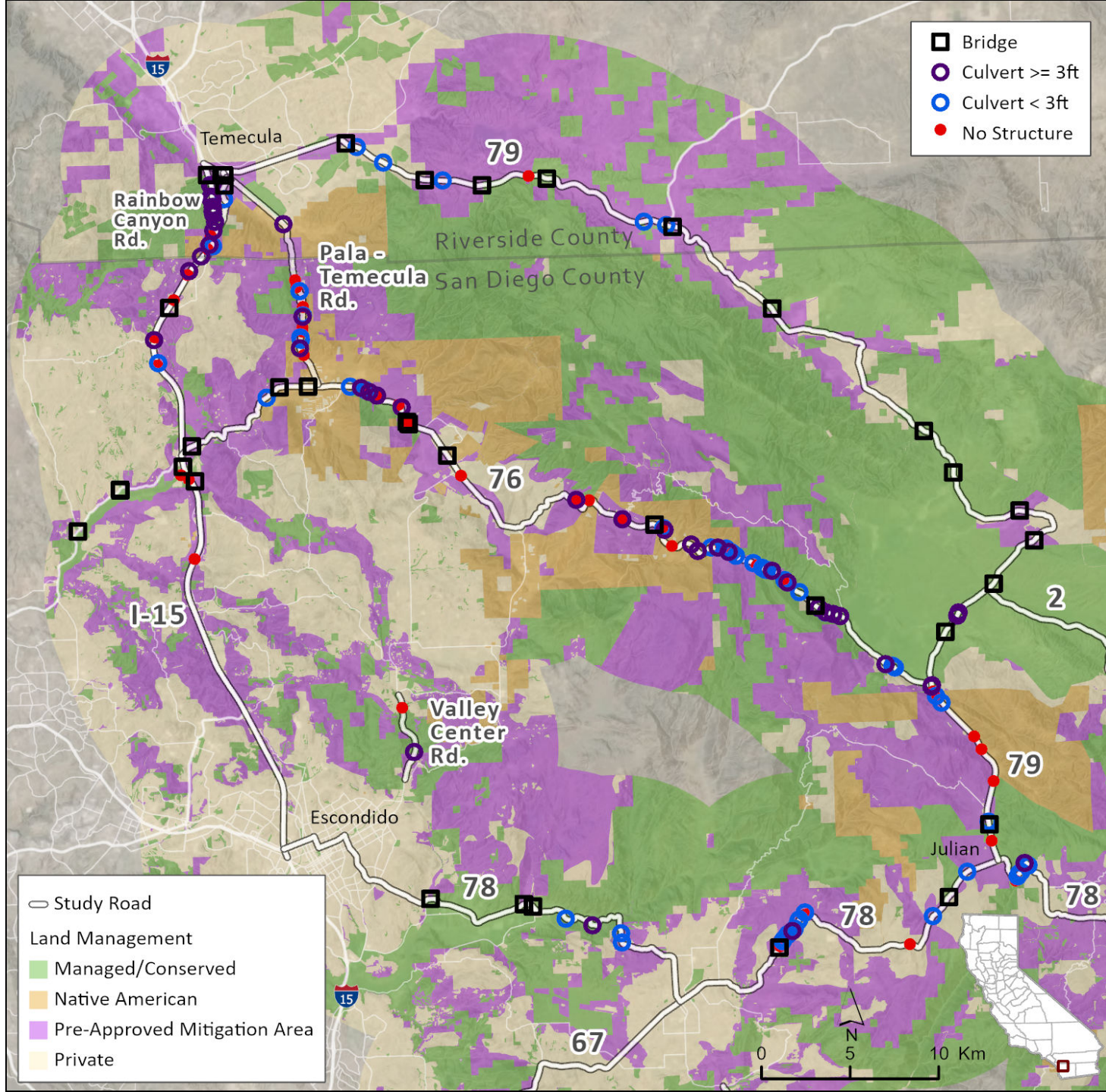
- 190 sites examined – full data from 183 sites, 2 others with structure grades
- Photos, descriptions , fencing, landscape recorded at all sites
- 64 were sites where known mountain lion crossings had occurred
- Only 16 of the 64 sites (25%) with known crossings had culverts or bridges suitable in size for mountain lion passage.
- Thus, most road crossings are occurring at grade – endangering lions and drivers

- Of the 185 sites examined and characterized:
- Culverts >3 ft dia: n=43 sites; 23%
- Bridges: n=36 sites; 19%
- Smaller culverts: n=49 sites; 26%
- No culvert or bridge: n=56 sites; 30%









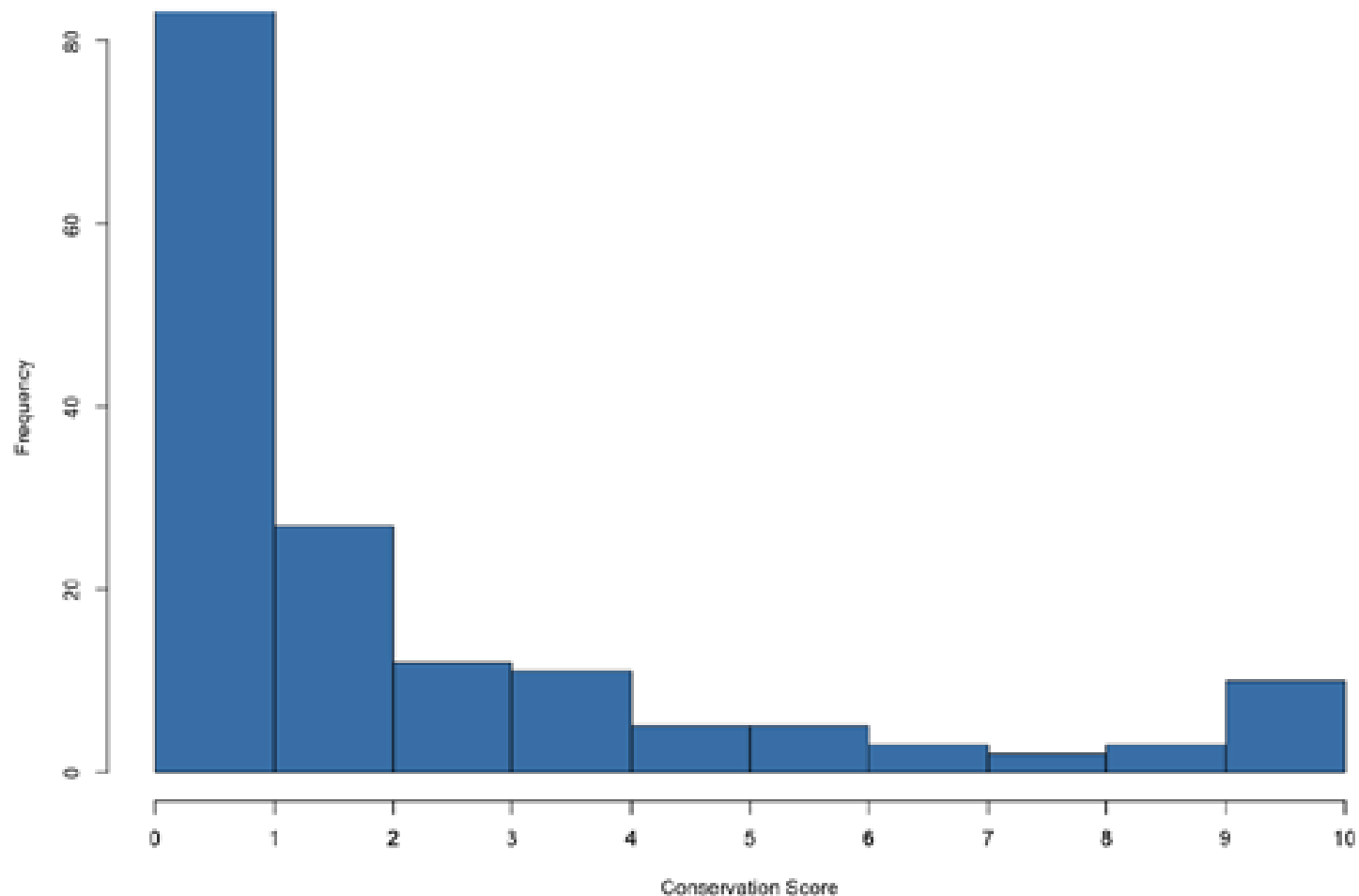


# Conservation near crossings

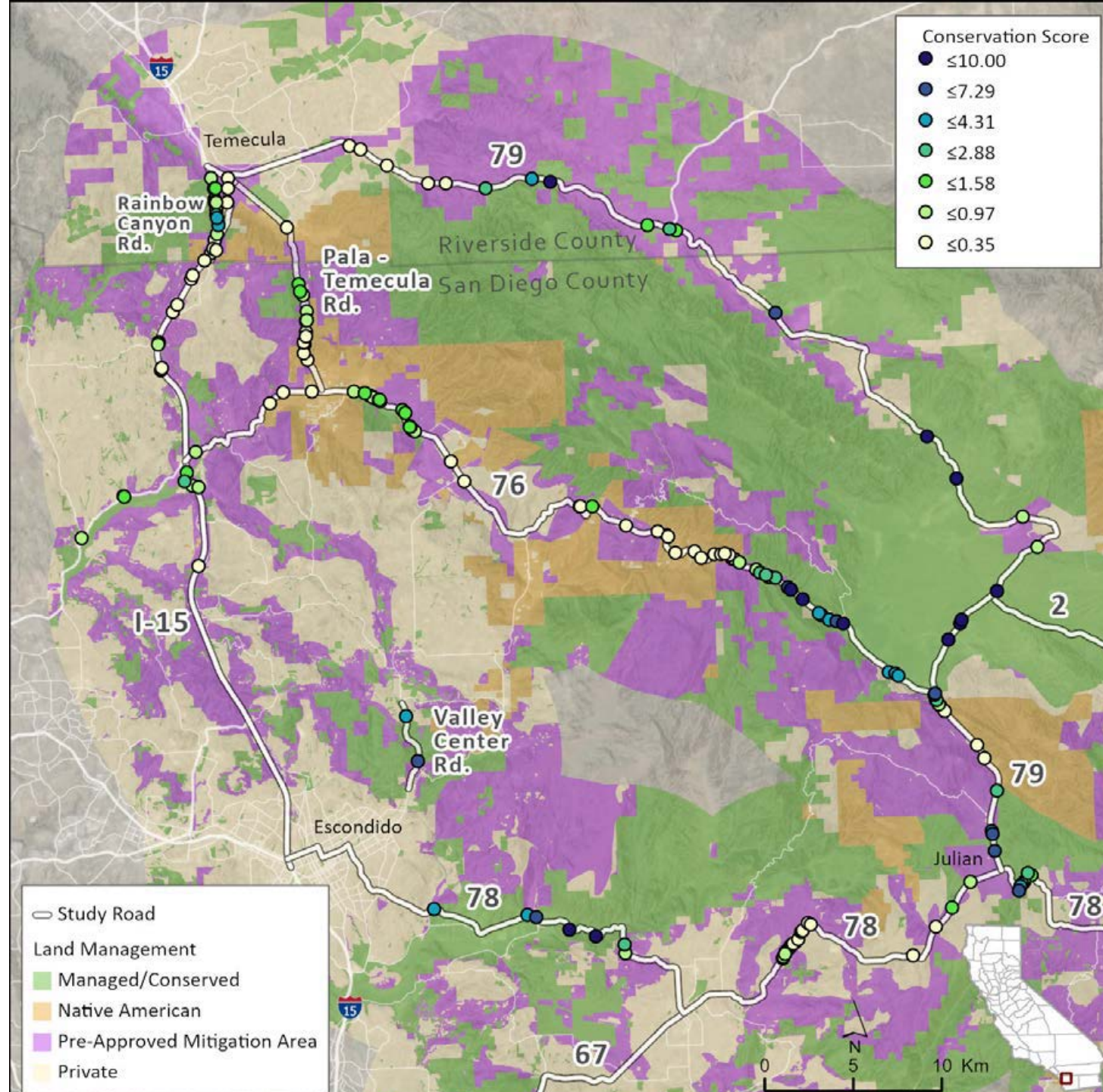
- Only 11% of crossing sites had over 50% of the land conserved within a 500 meter radius
- Only 15 of adequate sized crossing structures had conserved lands at the highway on both ends

Figure 4. Distribution of Conservation Scores across all surveyed sites.

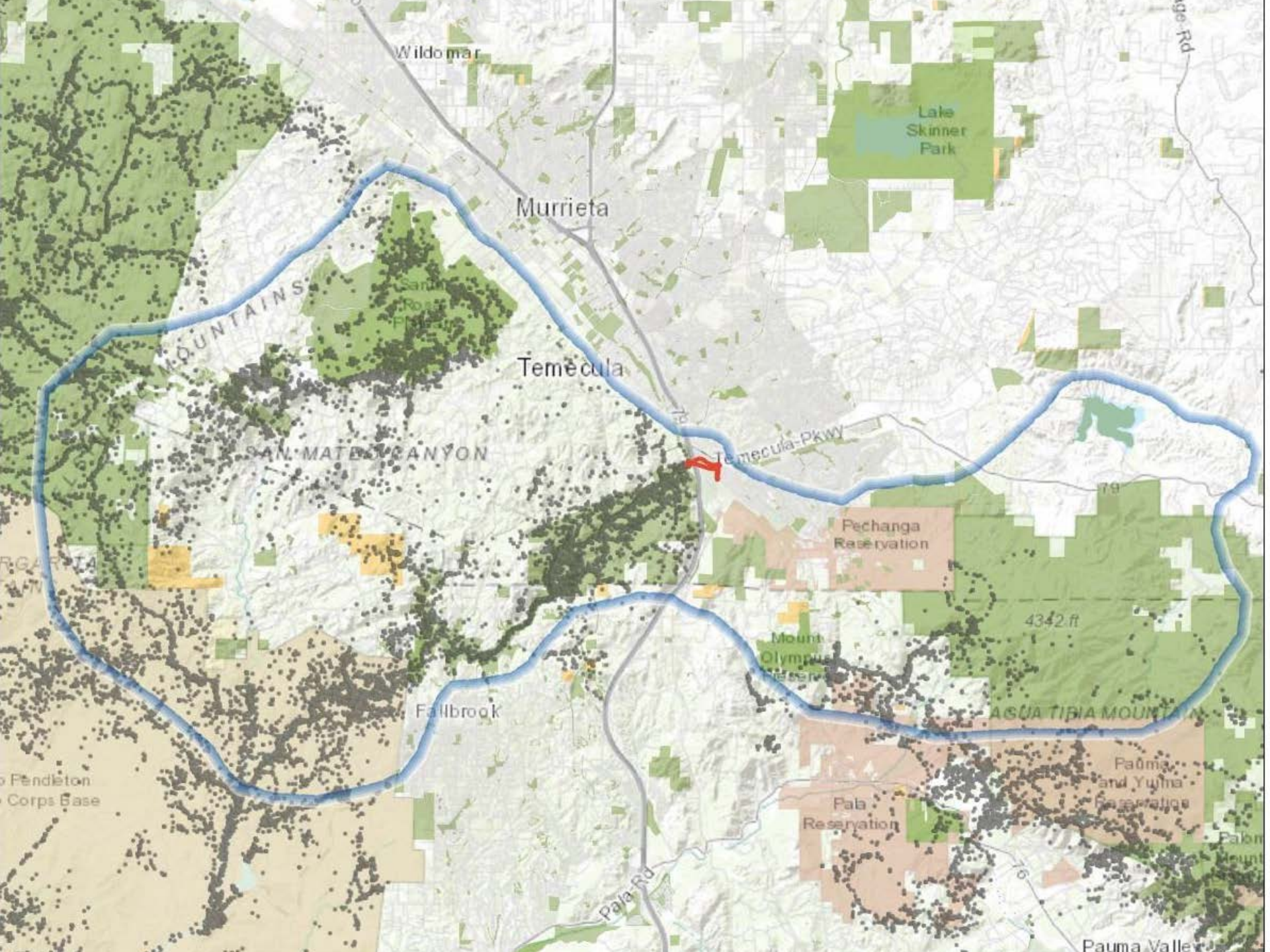
0 = 0% conserved, 10 = 100 % conserved















Temecula

ANYON

Temecula-Pkwy

Pechanga  
Reservation

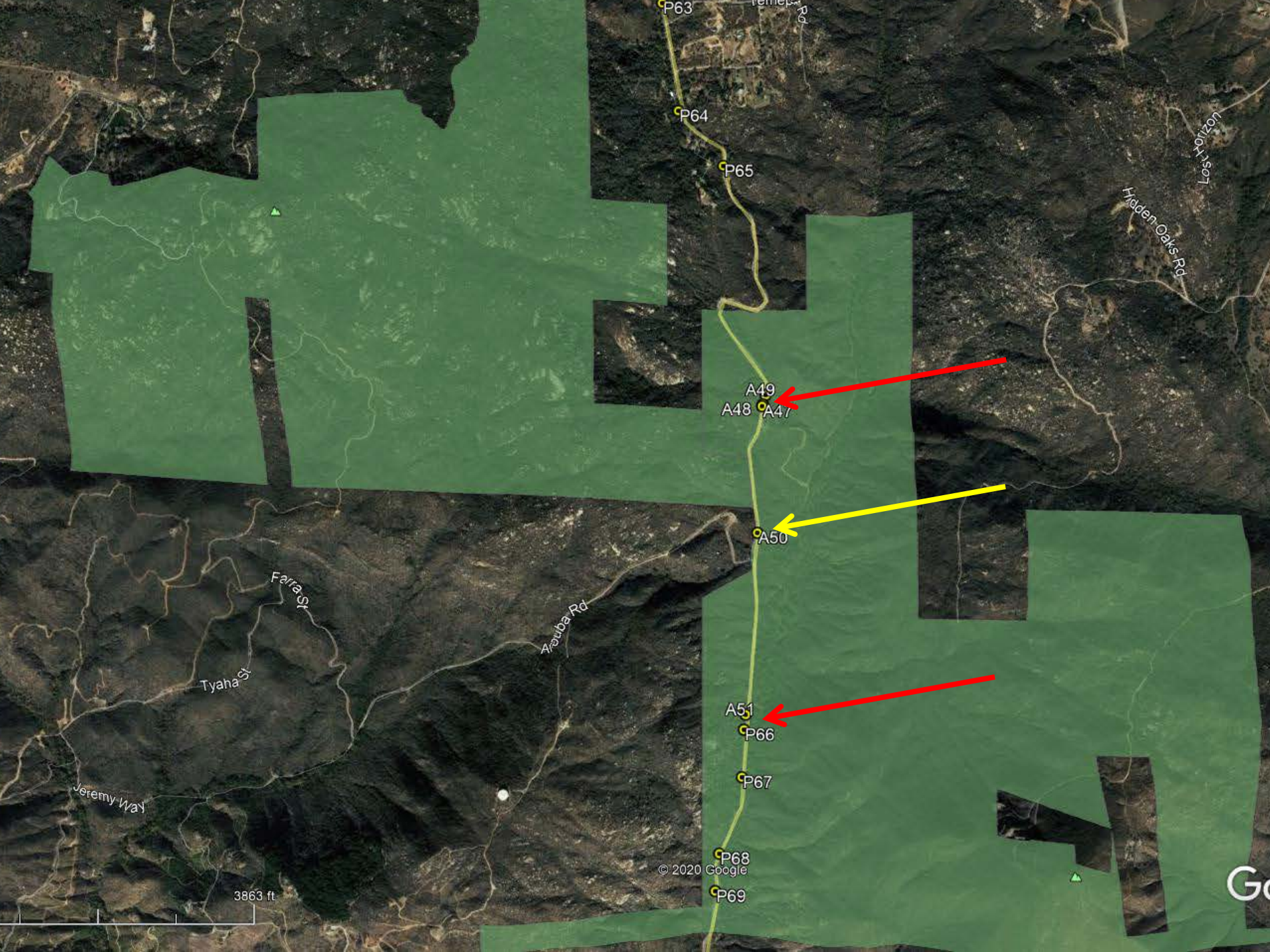
Mount  
Olympus  
Reserve

43

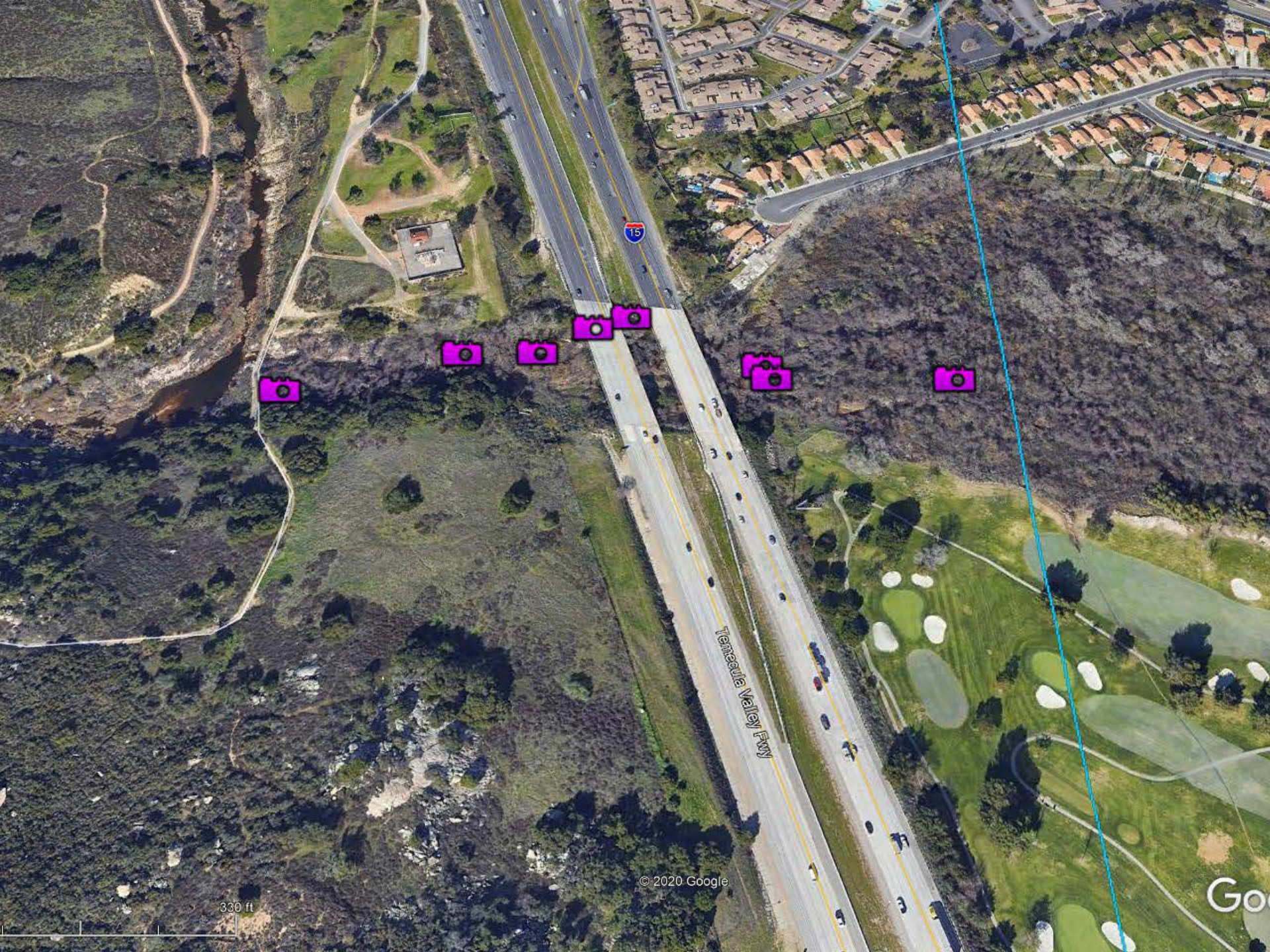
AGUA

Fallbrook

Pal







330 ft

© 2020 Google

Temecula Valley Fwy

Go





15

Pineculla Valley Hwy

Rainbow Canyon Rd

857 ft

© 2020 Google

Go



# I-15 / Temecula Creek Bridge camera study results as of Dec 2020

Mountain Lion	Bobcat	Coyote	Deer	Feral Pig	Fox	Striped Skunk	Spotted Skunk	Opossum	Raccoon	Ringtail	Trespassers	
10	455	578	0	0	841	353	117	2	931	16	581	Initial study - 199 days avg
6	318	550	0	0	305	364	55	89	832	14	949	Current study - days avg 217

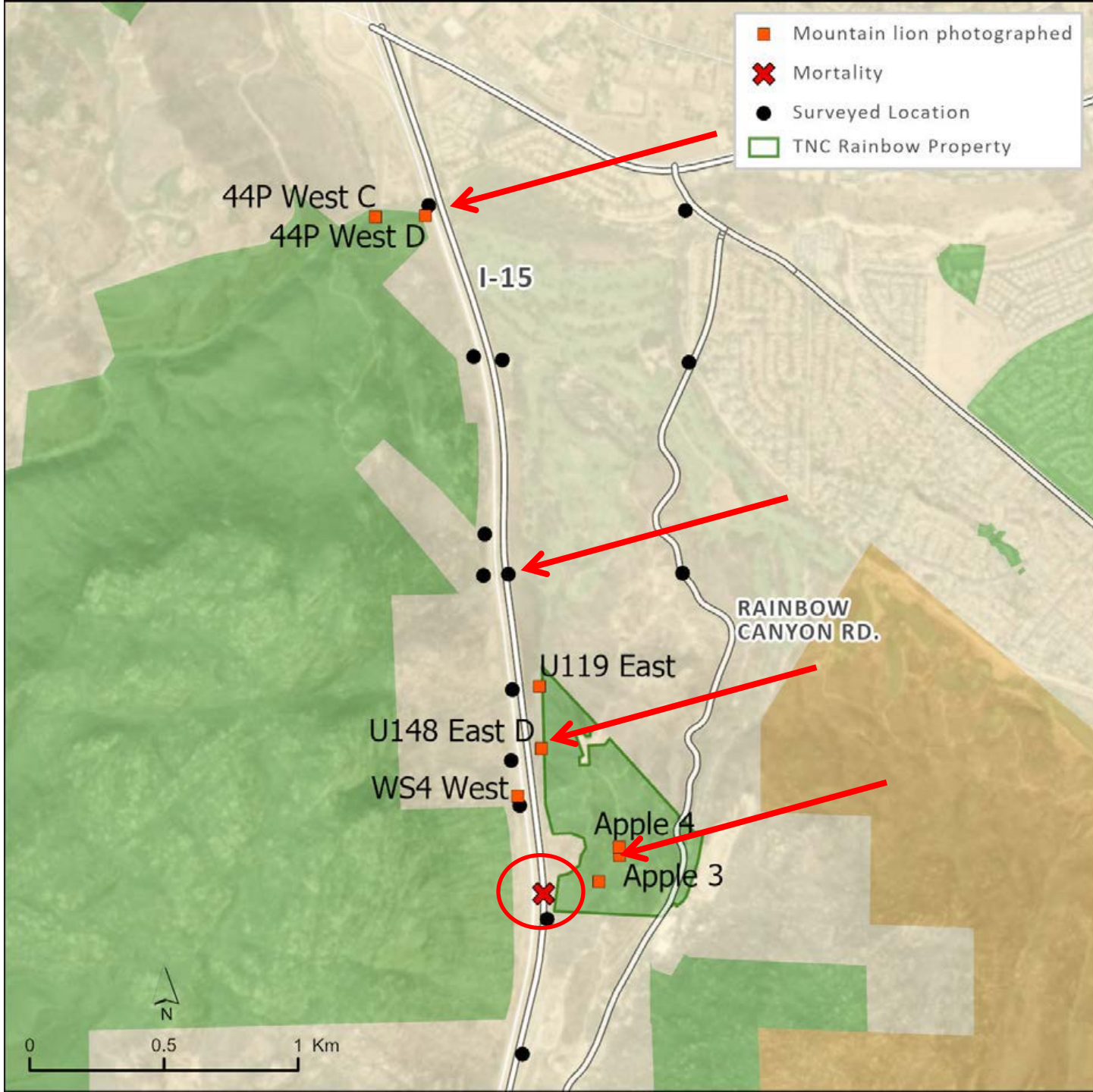
TNC property trespass numbers have **dropped to 121**

Temecula Creek Bridge trespass numbers have **increased to 814**

**Substantially more trespass in Santa Margarita River (swimming hole) than previously – up to over 100 per day**

People under Temecula Creek Bridge include apparent plant poachers, motor bike riders, and one naked guy (middle of the day)













50°F 10°C

07-24-2020 0









# Coyote and ringtail videos

# Cal Poly Pomona Project







# Improve Temecula Creek Bridge

- Fencing
- Signage
- Increased Patrols
- Sound baffles / berms / walls
- Vegetation mods
- TNC has planning grant from WCB

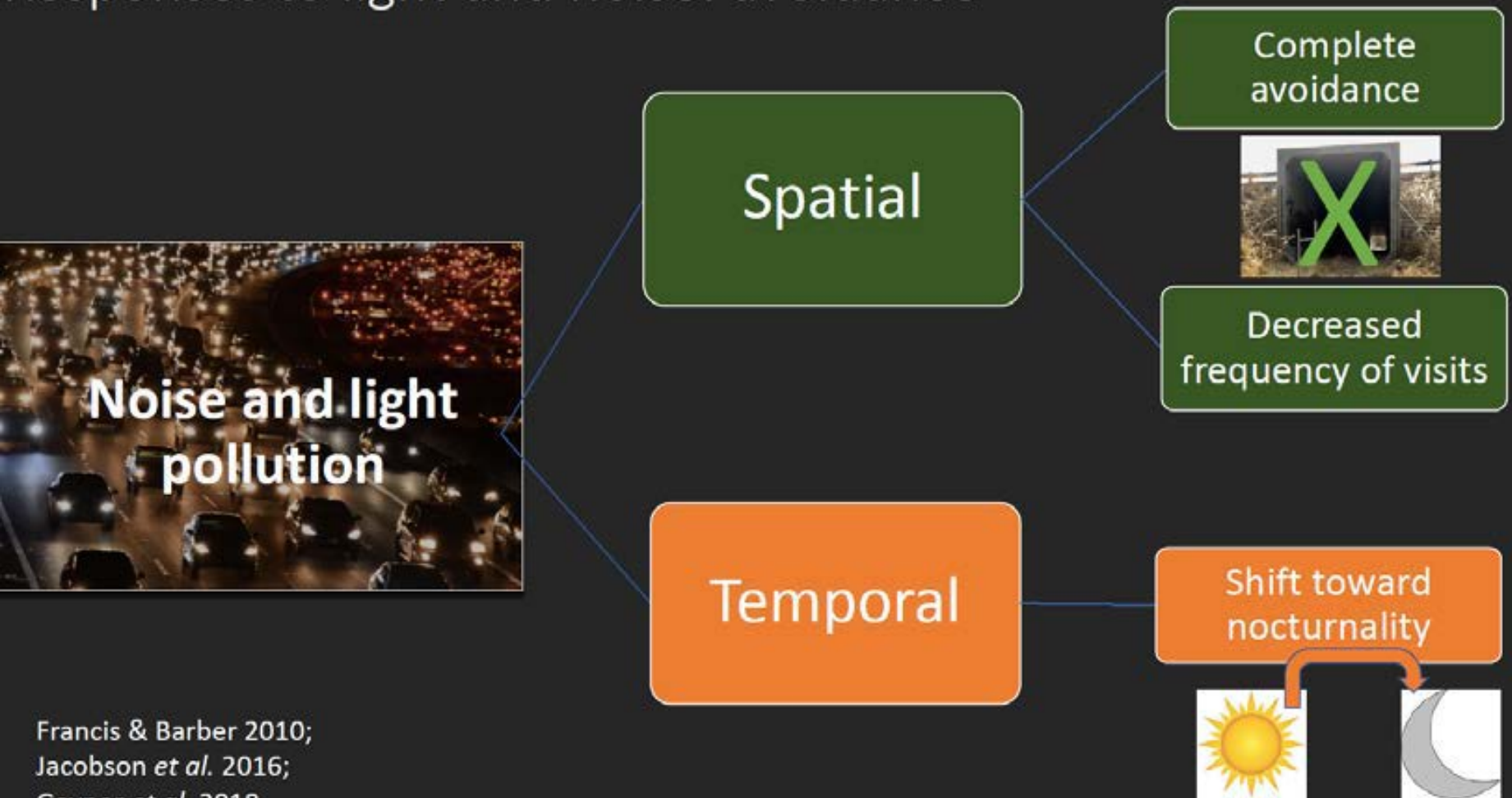


# Altair Settlement

- Established funding for patrol and some fencing
- Also established extra land conservation funding

# Pubs in prep and ongoing study Collins, Shilling, Longcore, Vickers

Responses to light and noise: avoidance



Francis & Barber 2010;  
Jacobson *et al.* 2016;  
Gaynor *et al.* 2018

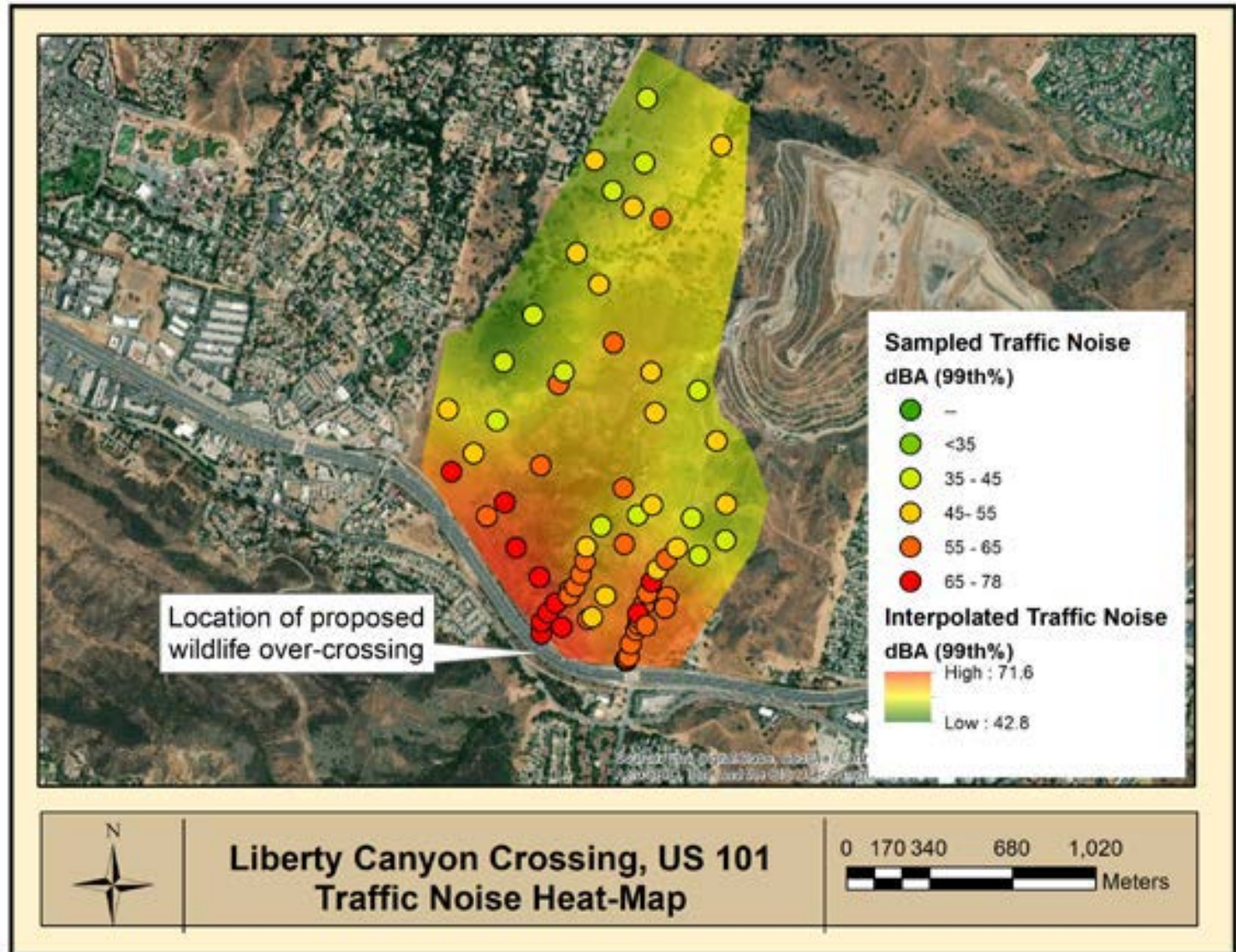




# Improving Light and Soundscapes for Wildlife use of Highway Structures – 101 Freeway and I-15

## Shilling, Vickers, Longcore, Stevens

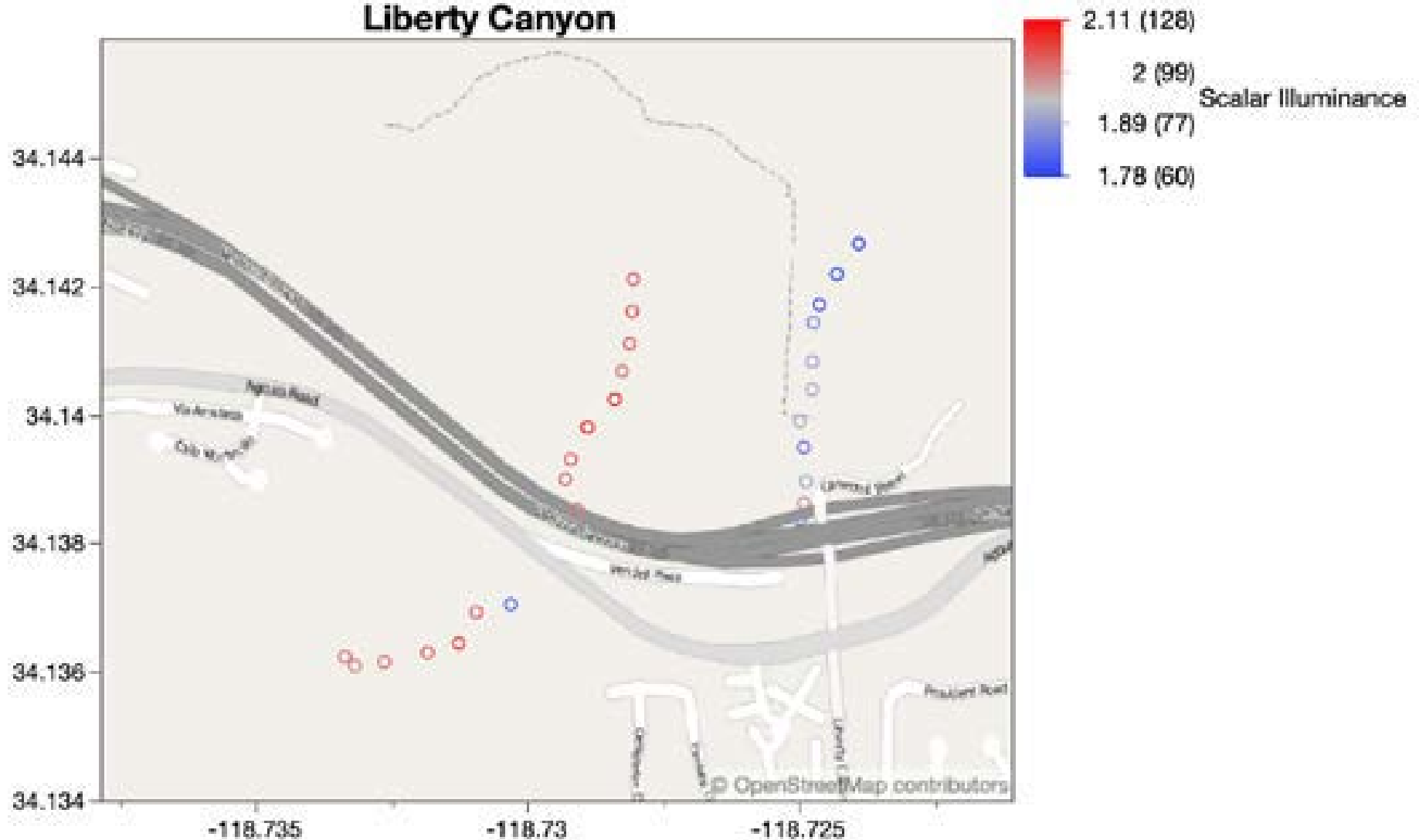
Noise  
mapping





# Luminescence mapping

## Liberty Canyon



# Update on deterrent study

- Collaborating with researchers in N. CA, CDFW, UCANR, NPS
- Testing at depredation sites
- About to begin testing at sites set up with attractants – sound and bait



# Santa Anas population estimation

## LAG, TNC, Panthera, WSU, UCD, CDFW

### funding and collaboration

- Genetic analysis of opportunistic samples with pedigree insertion (n=35) (Ernest, Gustafson, Vickers, Smith)
- Hair snare / camera study – DNA based mark recapture (Vickers, Manning)
- Camera based time to event and space to event study (Elbroch, Vickers)

Based on  
Colorado  
studies

Cubbies of  
limbs and  
brush  
approx.  
5x3x3 feet



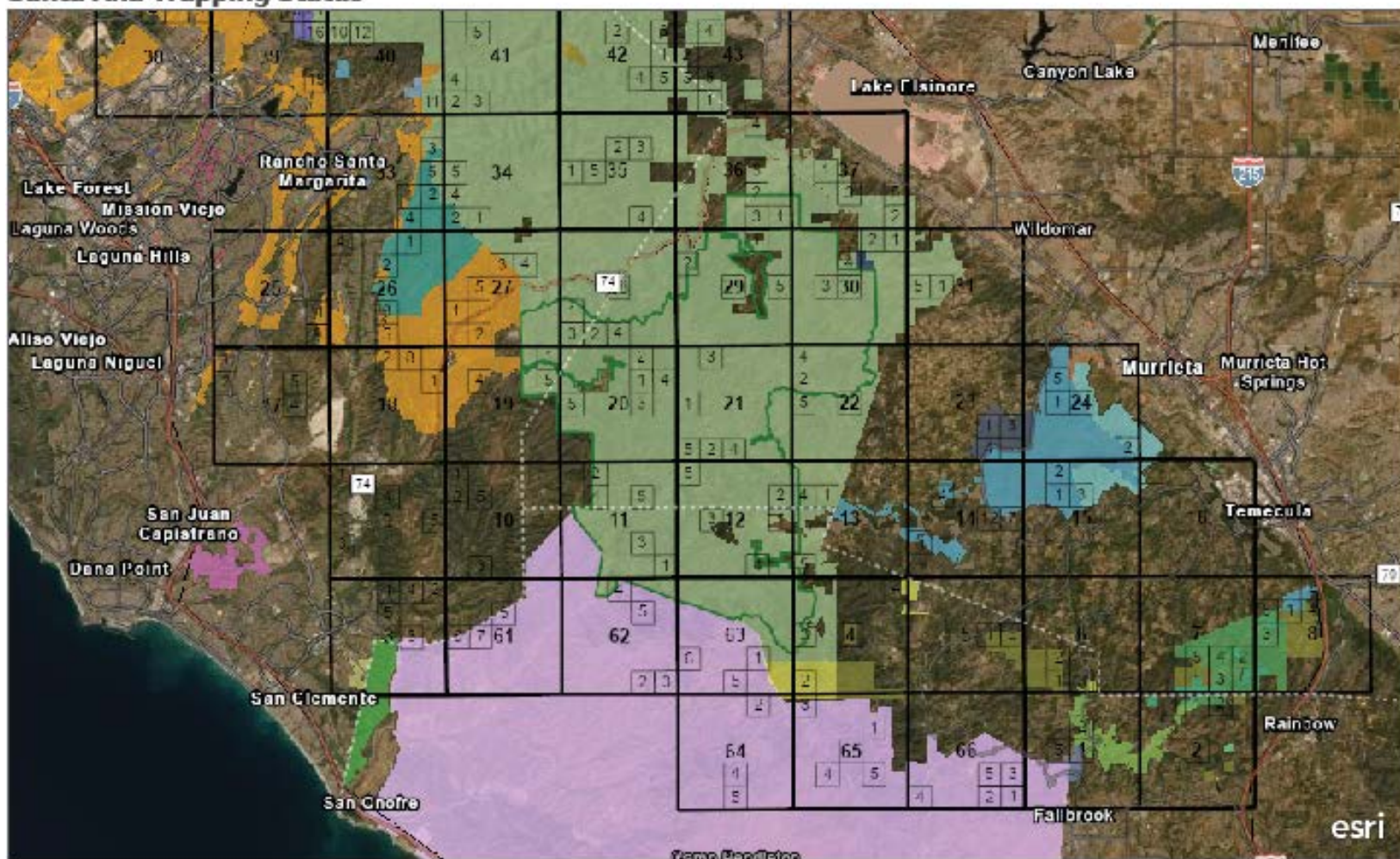


Altitude: 413m  
Datum: WGS-84  
Azimuth/Bearing: 070° N70E 1244mils (True)  
Zoom: 1X  
Test

Example Santa  
Anas cubby







Zeller KA, Vickers TW, Ernest HB, Boyce WM (2017) Multi-level, multi-scale resource selection functions and resistance surfaces for conservation planning: Pumas as a case study. PLoS ONE 12(6): e0179570. | Jeff Manning, Assistant Professor, Washington State University (jeff.manning@wsu.edu) (Co-PI and author) and T. Winston Vickers, DVM, University of California, Davis (twickers@ucdavis.edu) (PI). | Earthstar Geographics | County of Riverside, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA

5 x 5 km grid units – n=66

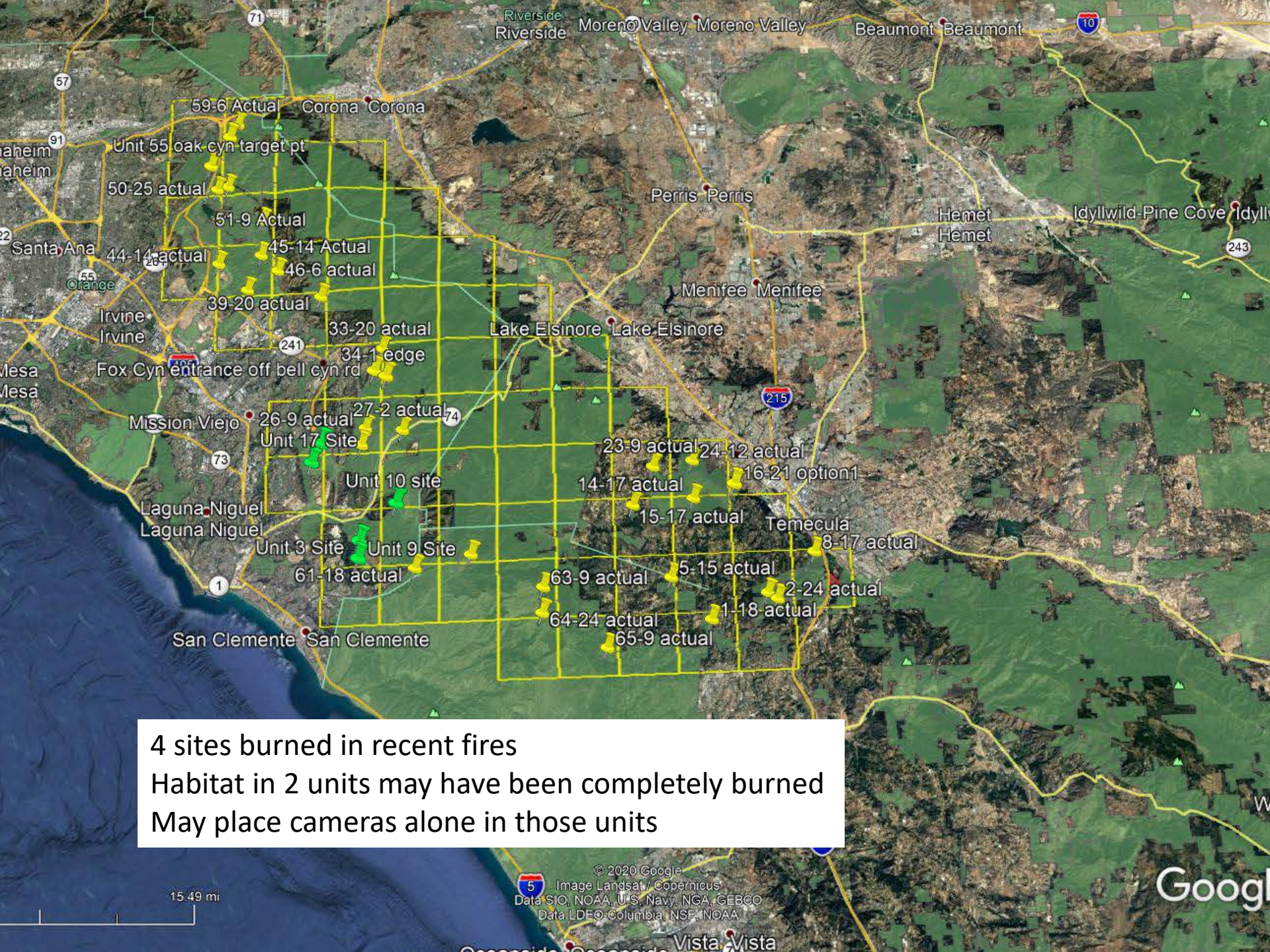
Divided into 1 x 1 km subunits – n=25

Subunits ranked according to historical use by pumas based on GPS data

Hair sampling sites placed in top ranked subunits – 2-3 cams per site

2 cameras placed randomly in each unit





4 sites burned in recent fires  
Habitat in 2 units may have been completely burned  
May place cameras alone in those units



# New / In Progress w/UCD collaboration

- Statewide Survival Analysis
- Statewide Fire Effects Analysis
- Statewide Population Estimation
- Comparisons of disease and toxin exposure and habitat use and mortality patterns between rural NE CA, Bay Area Wine Country, and So Cal



# Videos

# Thank you - Questions?



Winston Vickers

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