Mountain Lion Connectivity in San Diego County

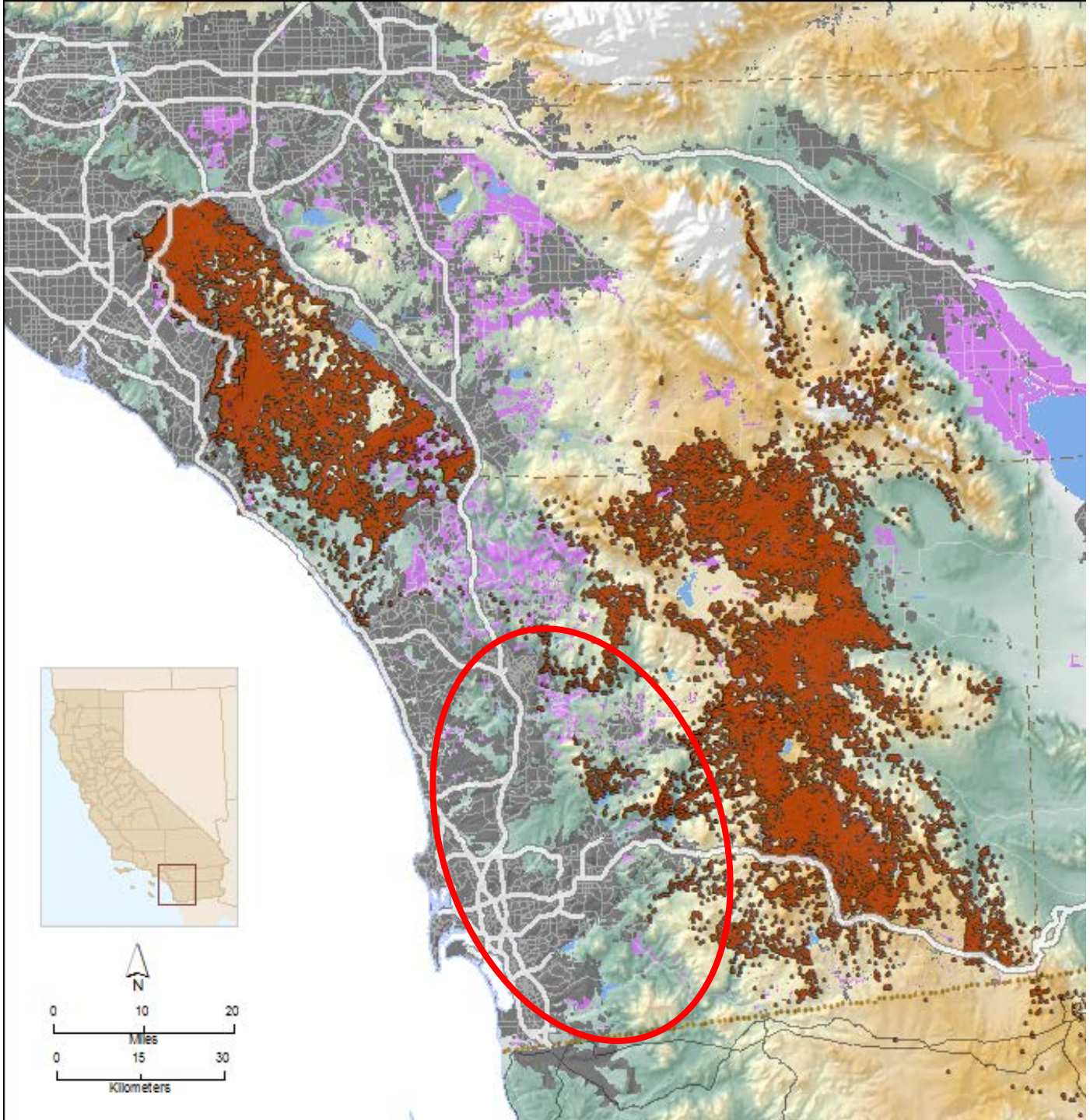
UC Davis Wildlife Health Center Southern CA Cougar Project

Winston Vickers, Walter Boyce, Donna Krucki, Preston Taylor

Western Tracking Company

Barry Martin, Kimberly Davis, Tom Ryan, Cody Wallace


Photo by Eric York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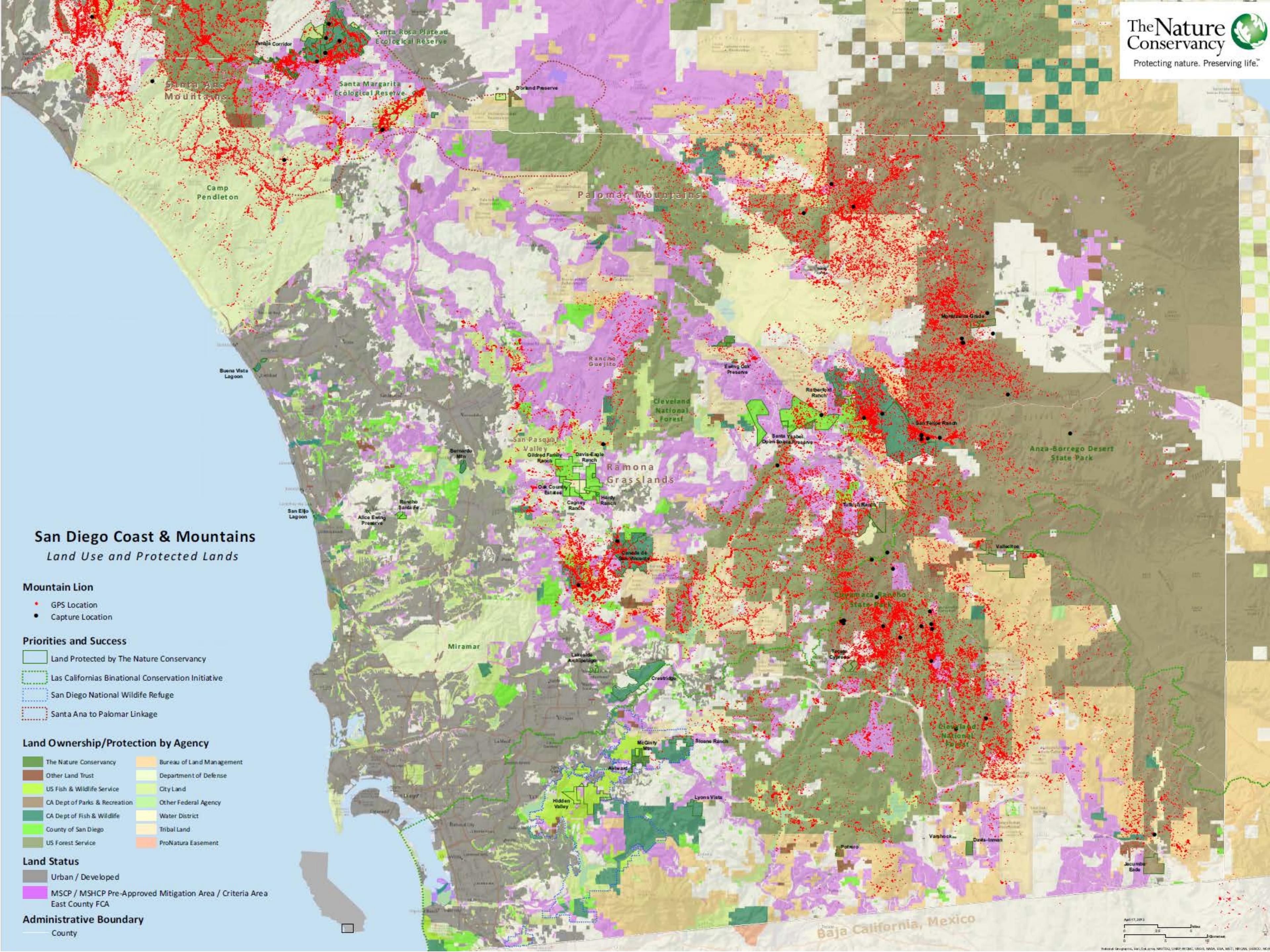
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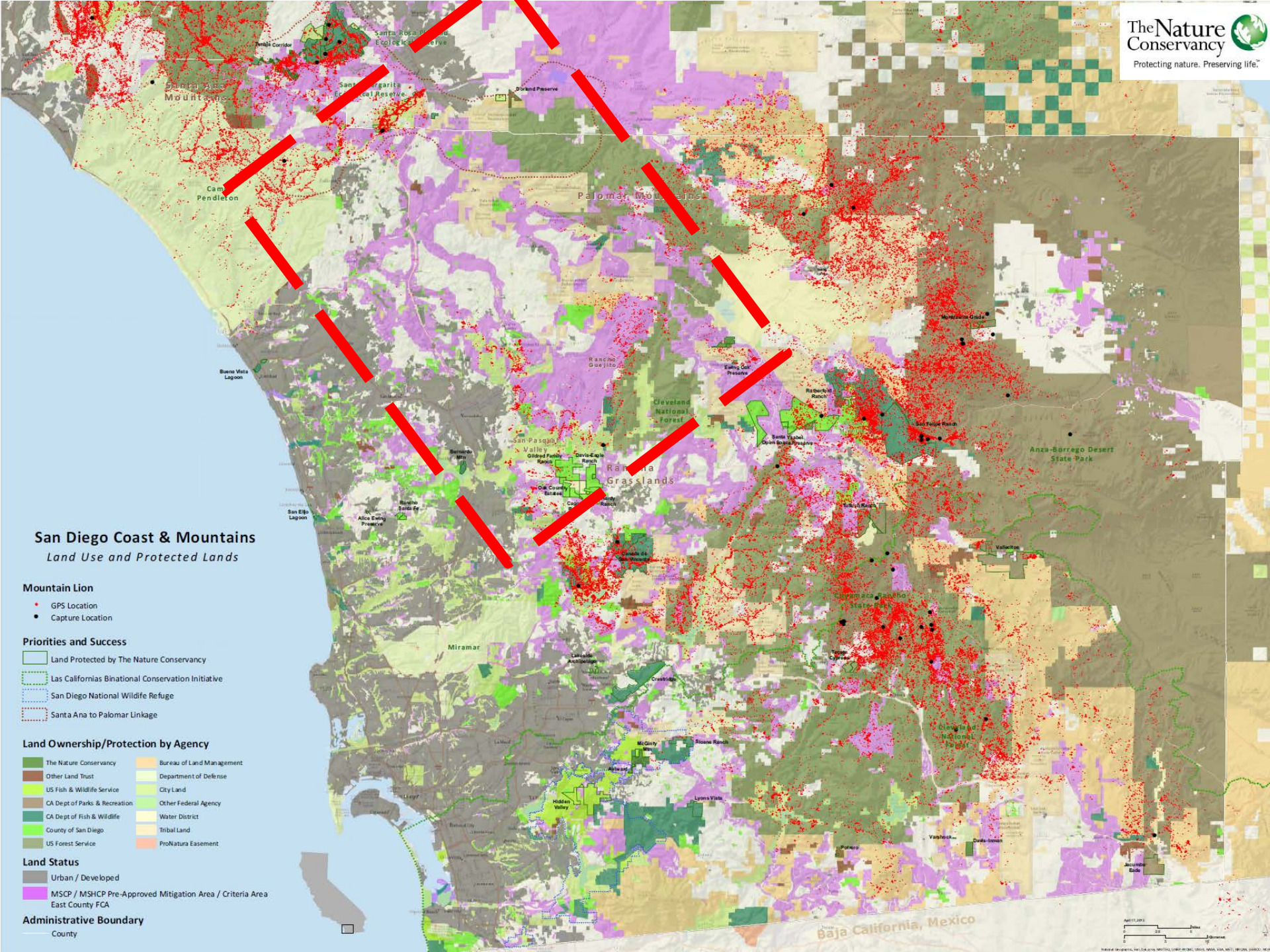
San Diego Coast & Mountains
Land Use and Protected Lands
Mountain Lion
GPS Location
Capture Location
Priorities and Success
Land Protected by The Nature Conservancy
Las Californias Binational Conservation Initiative
San Diego National Wildlife Refuge
Santa Ana to Palomar Linkage
Land Ownership/Protection by Agency
The Nature Conservancy
Other Land Trust
US Fish & Wildlife Service
CA Dept of Parks & Recreation
CA Dept of Fish & Wildlife
County of San Diego
US Forest Service
Bureau of Land Management
Department of Defense
City Land
Other Federal Agency
Water District
Tribal Land
ProNatura Easement
Land Status
Urban / Developed
MSCP / MSHCP Pre-Approved Mitigation Area / Criteria Area
East County FCA
Administrative Boundary
County
Santa Rosa Plateau
Ecological Reserve
Santa Margarita
Ecological Reserve
Santa Ana
Mountains
Camp
Pendleton
Palomar Mountains
Buena Vista
Lagoon
Rancho
Guejito
Cleveland
National
Forest
San Pasqual
Valley
Ramona
Grasslands
San Elijo
Lagoon
Miramar
Anza-Borrego Desert
State Park
Cuyamaca Rancho
State Park
Cleveland
National
Forest
Hidden
Valley
Baja California, Mexico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Camp Pendleton
Palomar Mountains
Cleveland National Forest
Anza-Borrego Desert State Park
Ramona Grasslands
San Pasqual Valley
Miramar
Baja California, Mexico
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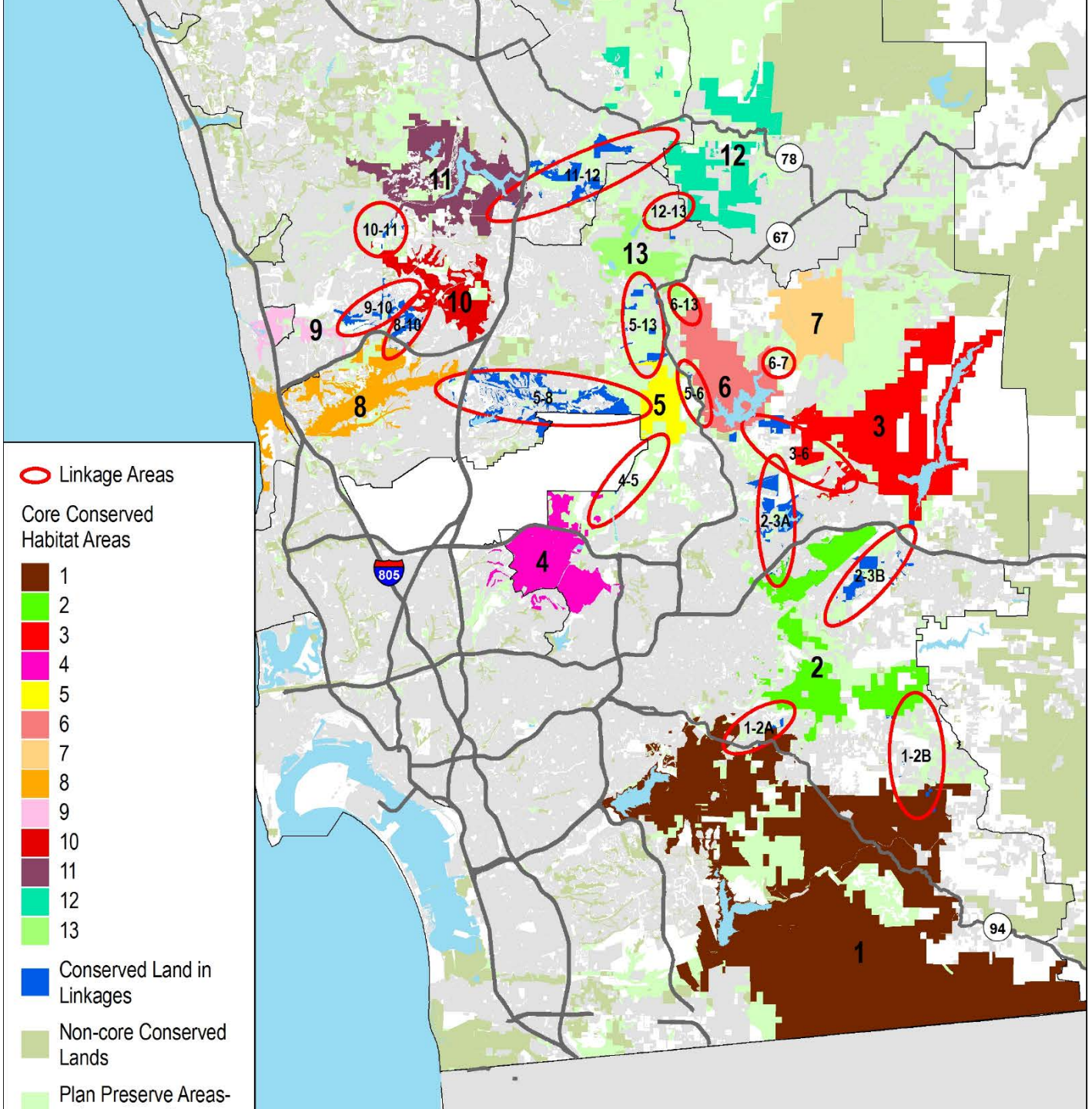
Linkage Areas
Core Conserved Habitat Areas
1
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12
13
Conserved Land in Linkages
Non-core Conserved Lands
Plan Preserve Areas-
11-12
12-13
10-11
9-10
8-10
5-13
6-13
6-7
5-8
5-6
4-5
3-6
2-3A
2-3B
1-2A
1-2B
805
78
67
94

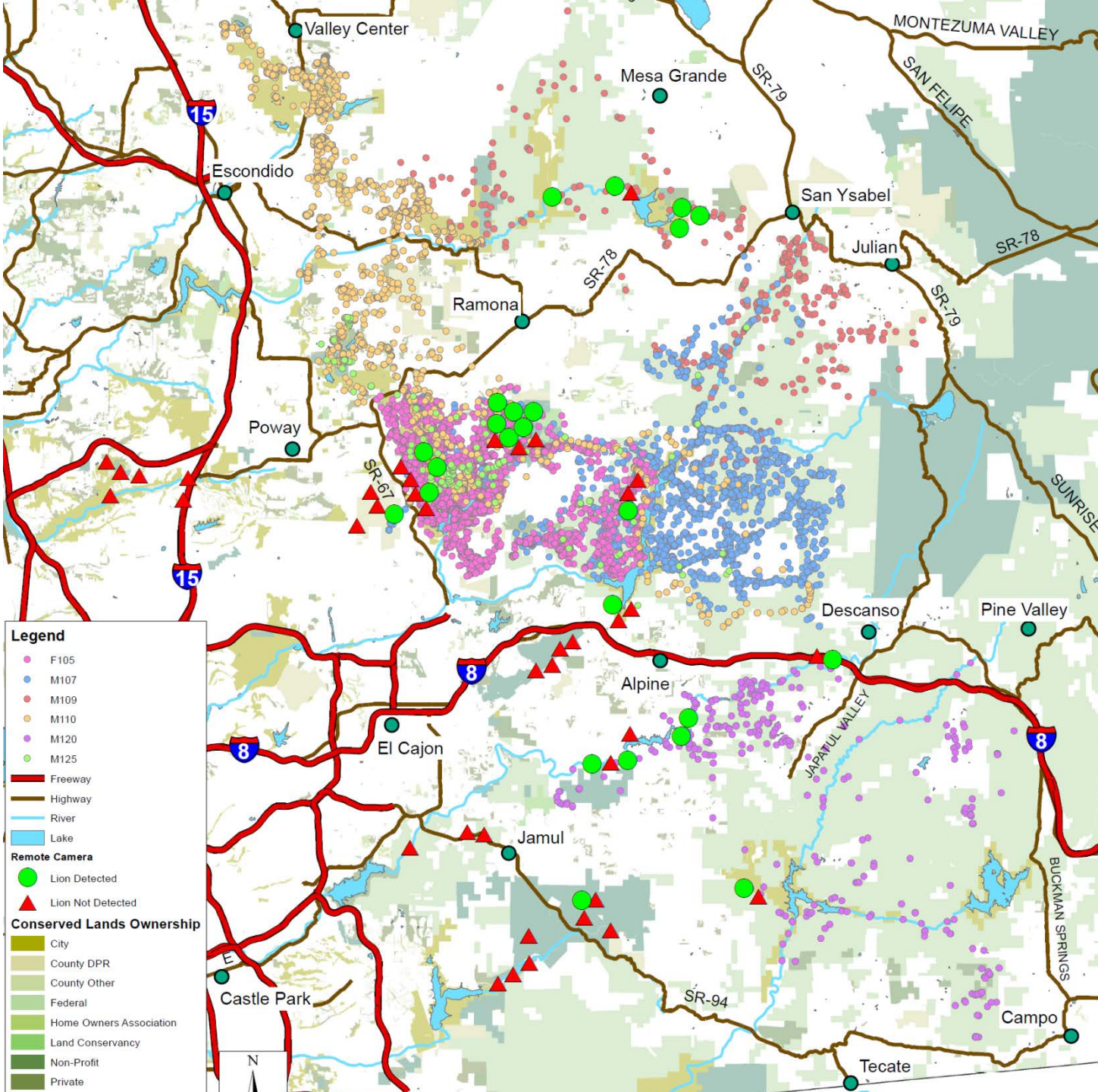
Core Conserved Area	Targeted in this study for assessment of mountain lion use	Linkages	Targeted in this study for assessment of mountain lion use
1. Hollenbeck-Otay	Yes	1-2A 1-2B	Yes Yes
2. Crestridge-Cleveland Nat. For.-Sycuan Peak	Yes	2-3A 2-3B	Yes Yes
3. El Capitan reservoir-Cleveland National Forest	Yes	3-6	Yes
4. Mission Trails	No	4-5	No
5. Sycamore Canyon	Yes	5-6 5-8 5-13	Yes Yes Yes
6. San Vicente reservoir-Boulder Oaks-San Vicente Highlands	Yes	6-7 6-13	Yes Yes
7. Canada de San Vicente	Yes	7-3 (not prev. ID'd	Yes (during study)
8. Penasquitos-Deer Canyon	Not originally but added mid-study	8-10	No
9. Del Mar Heights area	No	9-10	No
10. Black Mountain	No	10-11	No
11. Lake Hodges	No	11-12	No
12. Boden Canyon-Pamo Valley area	Yes	12-13	Yes
13. Mt. Woodson-Blue Sky Ecological Reserve area	Yes		

Cameras placed in areas thought likely for puma movement

Cameras placed at 63 sites

Over 24,000 total camera trap nights

Pumas photographed 141 times at 24 sites




Bushnell
055°F
2014/02/09 17:21:08

6 pumas collared 7 times

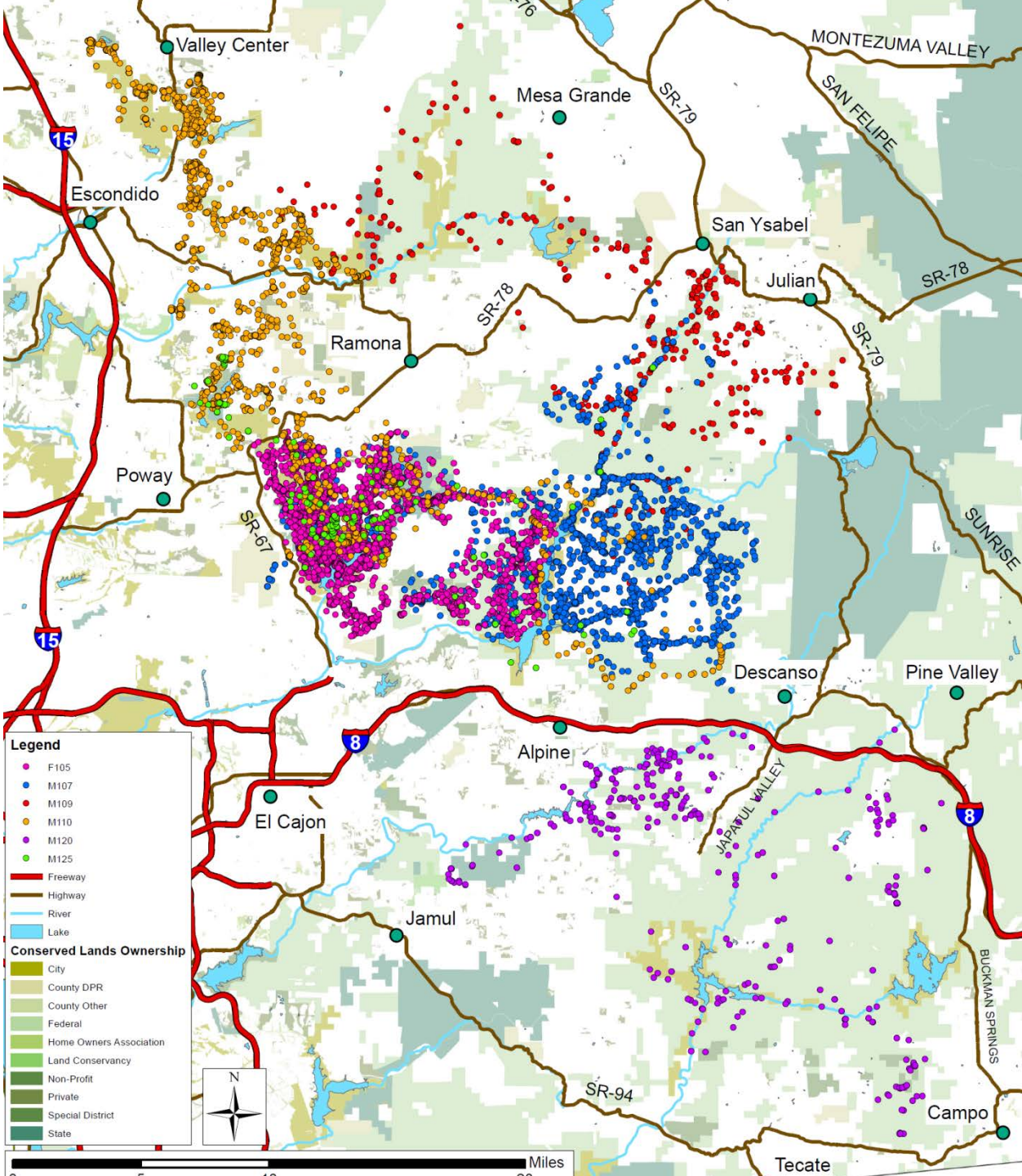
Data point q 1 hr except 1 animal (q 2hr)

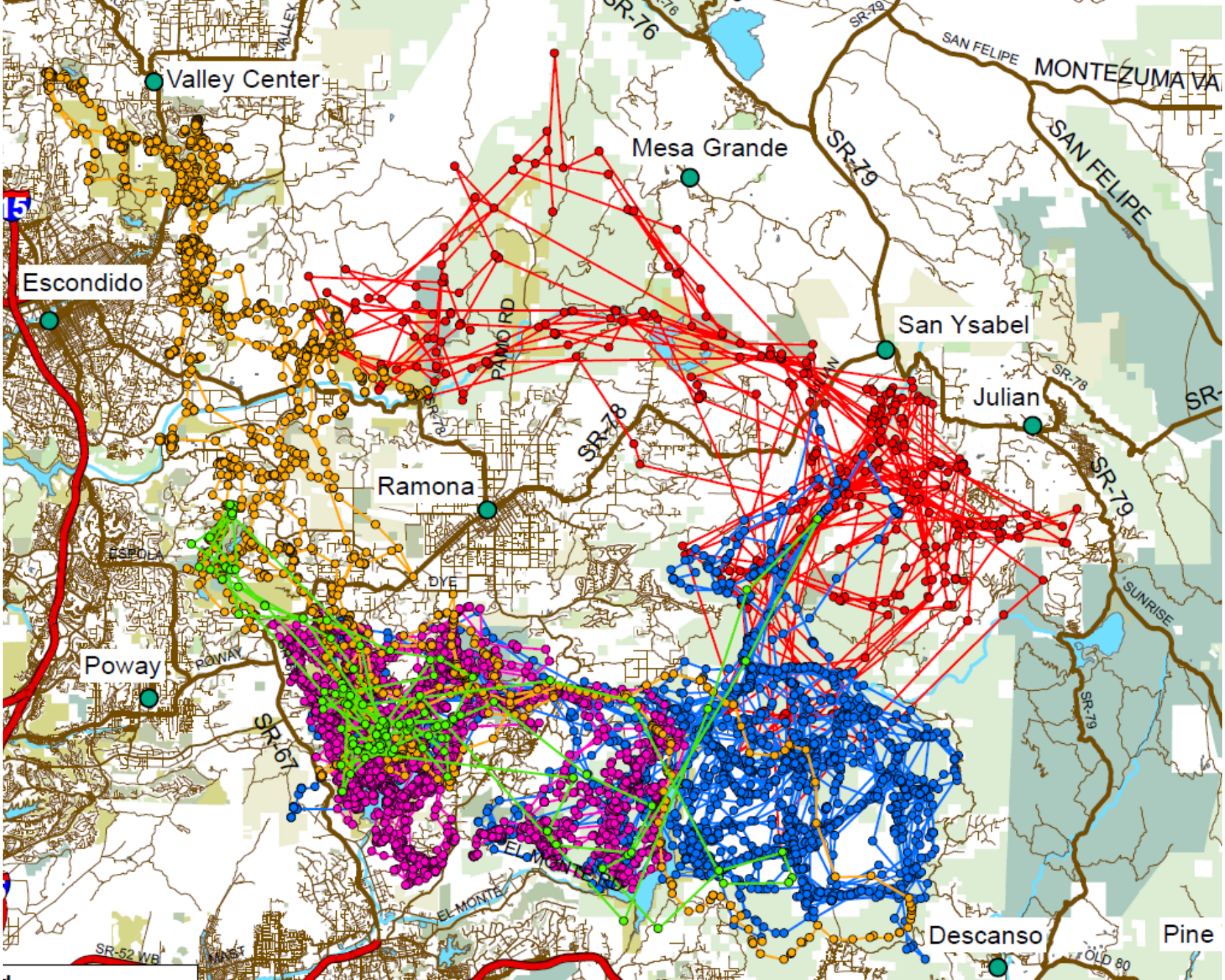
2 deceased within 1 yr (vehicles)

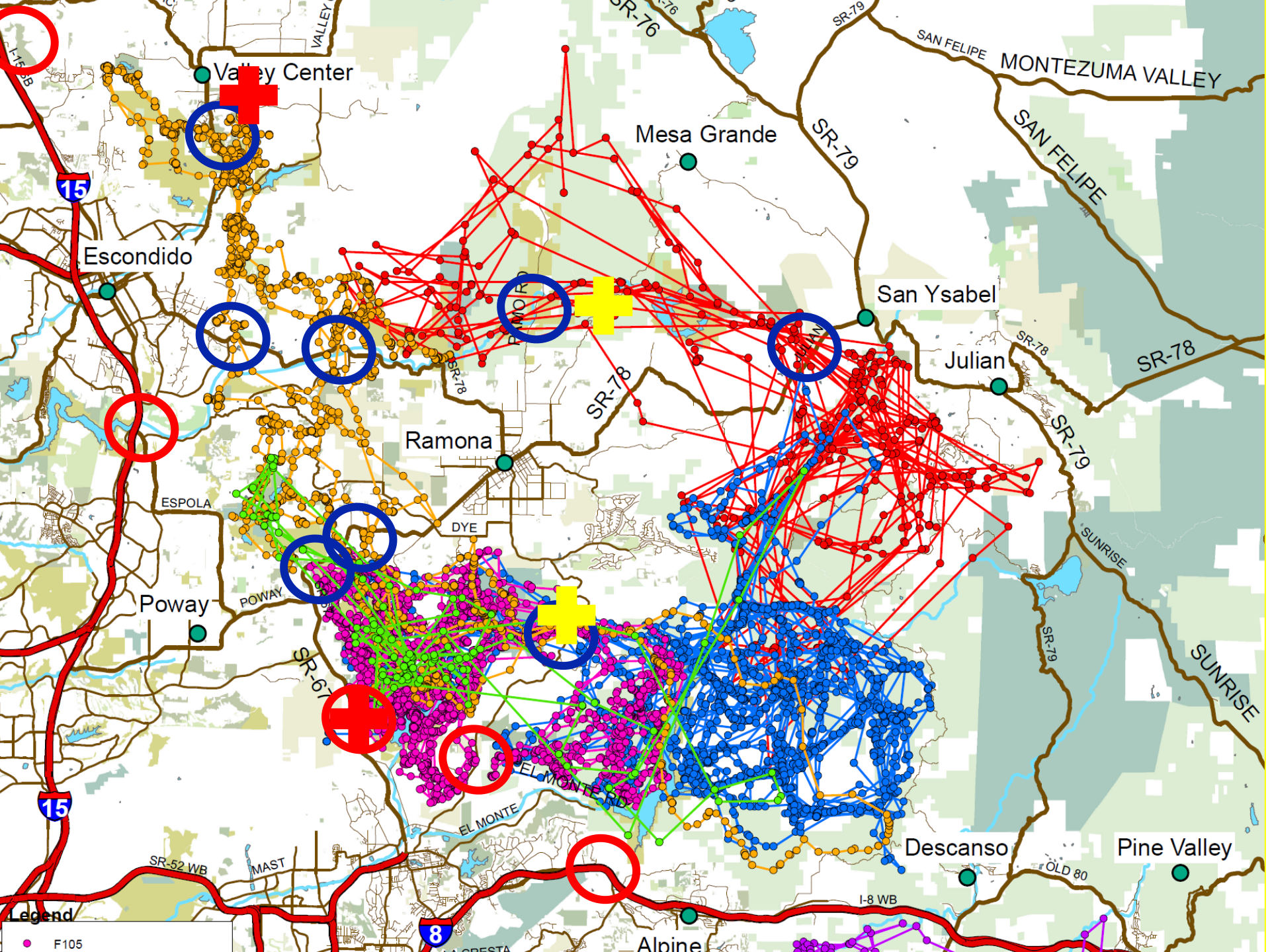
1 likely struck by vehicle in first year but survived

1 suffered trauma (broken foot) in first year but survived though collar stopped function – possible vehicle strike – recollared

1 depredated a domestic animal but owner did not get permit to have killed




Valley Center
Mesa Grande
Escondido
San Ysabel
Julian
Ramona
Poway
Descanso
SR-76
SR-79
SR-78
SR-67
SAN FELIPE
MONTEZUMA VA
PAMO RD
DYE
SUNRISE
EL MONTE
ESPOLA
POWAY
SR-52 WB
OLD 80
Pine


Valley Center
Escondido
Mesa Grande
San Ysabel
Julian
Ramona
Poway
Descanso
Pine Valley
Alpine
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SR-79
SR-78
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SR-52 WB
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MONTEZUMA VALLEY
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ESPOLA
DYE
POWAY
EL MONTE
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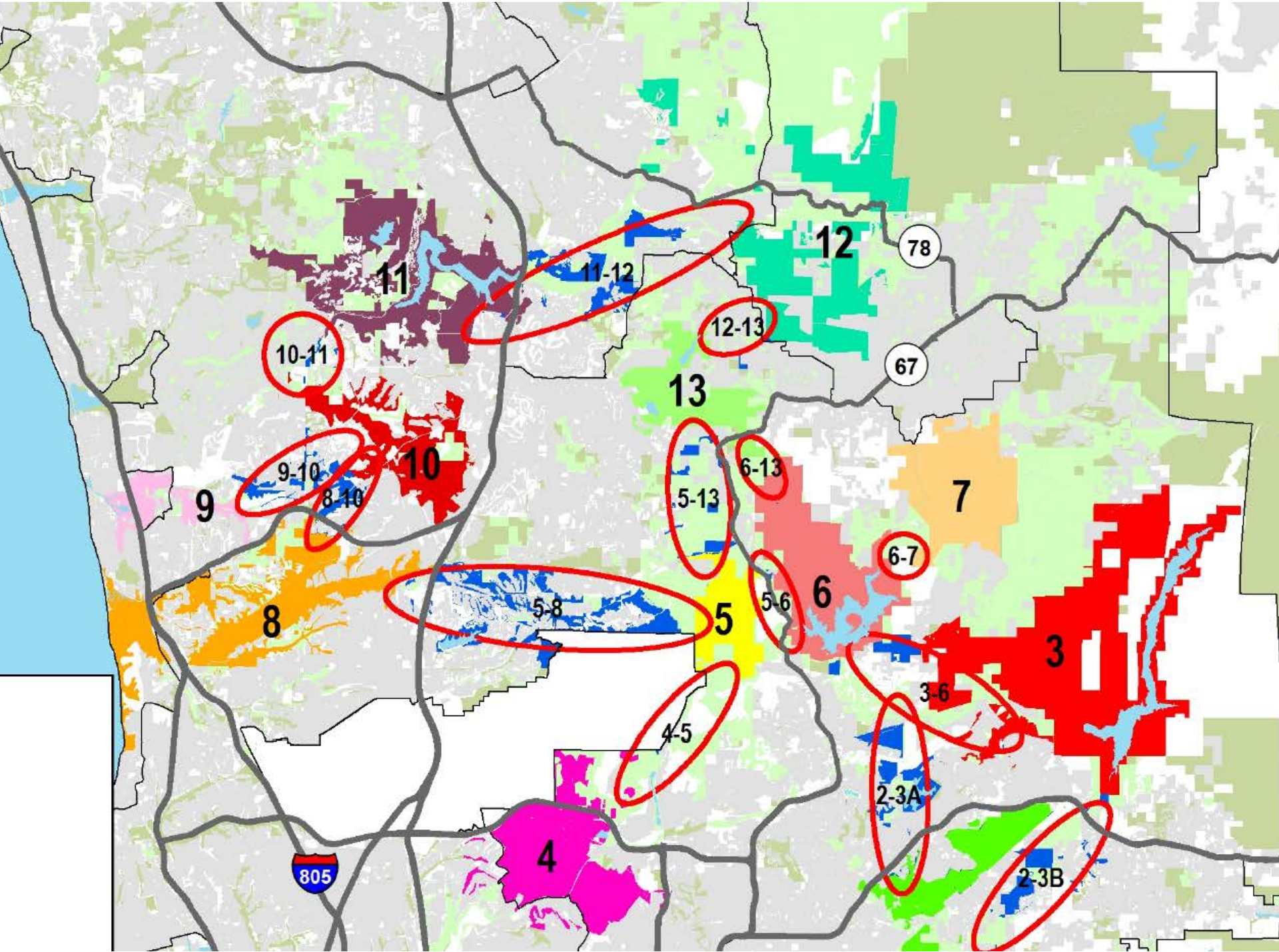
OLD 80
Legend
F105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3-6
4-5
2-3A
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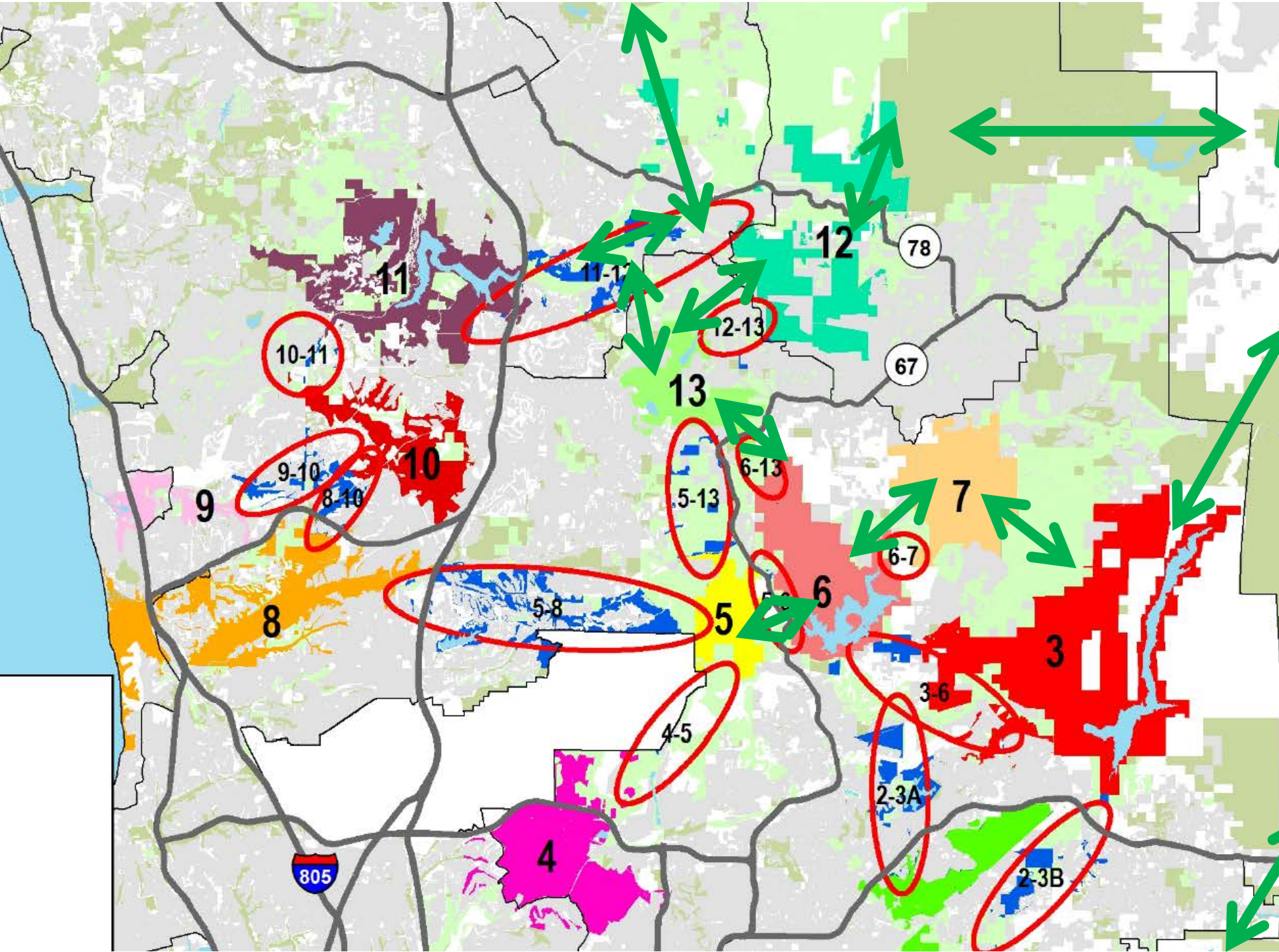
805
2-3B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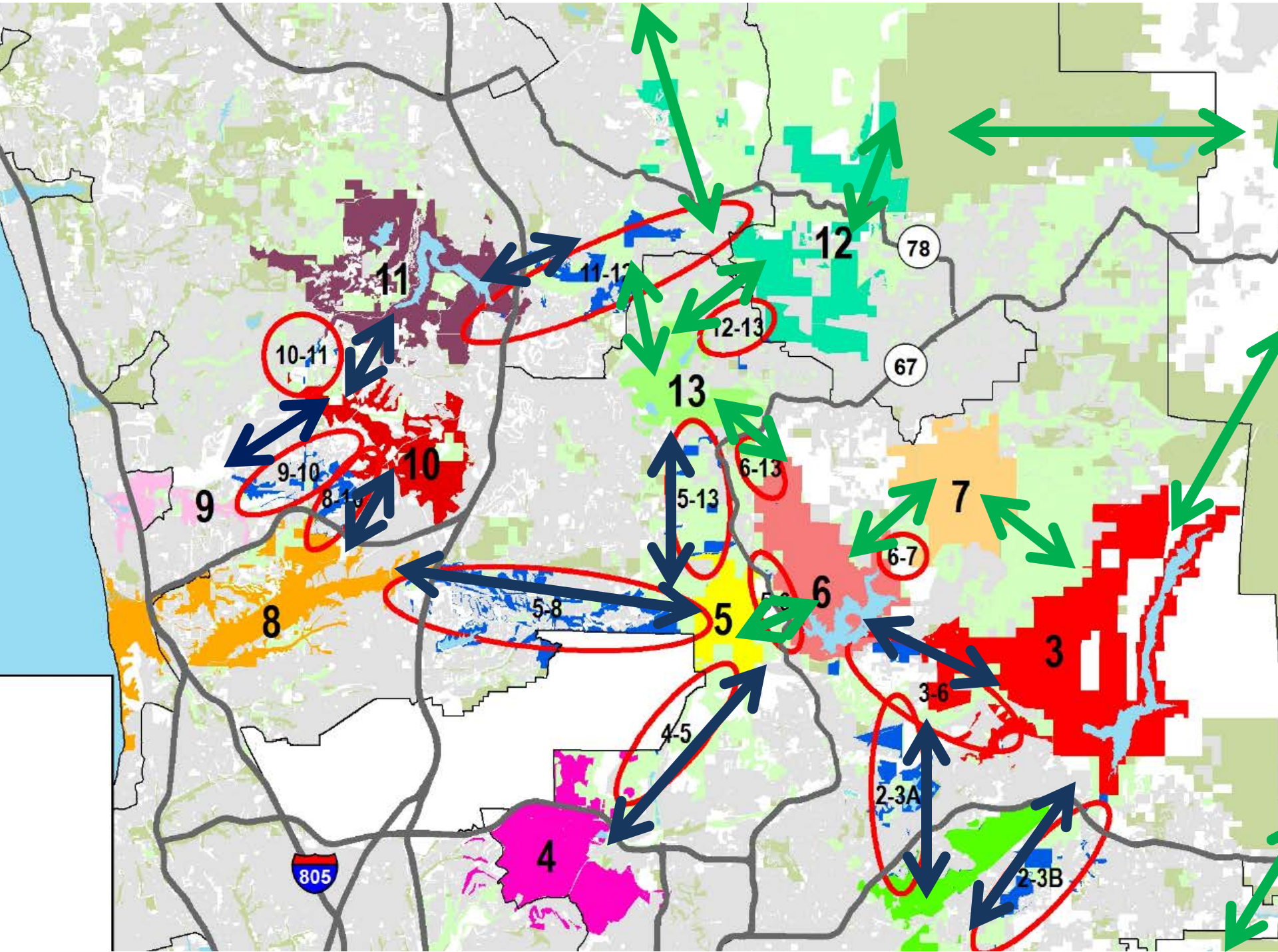
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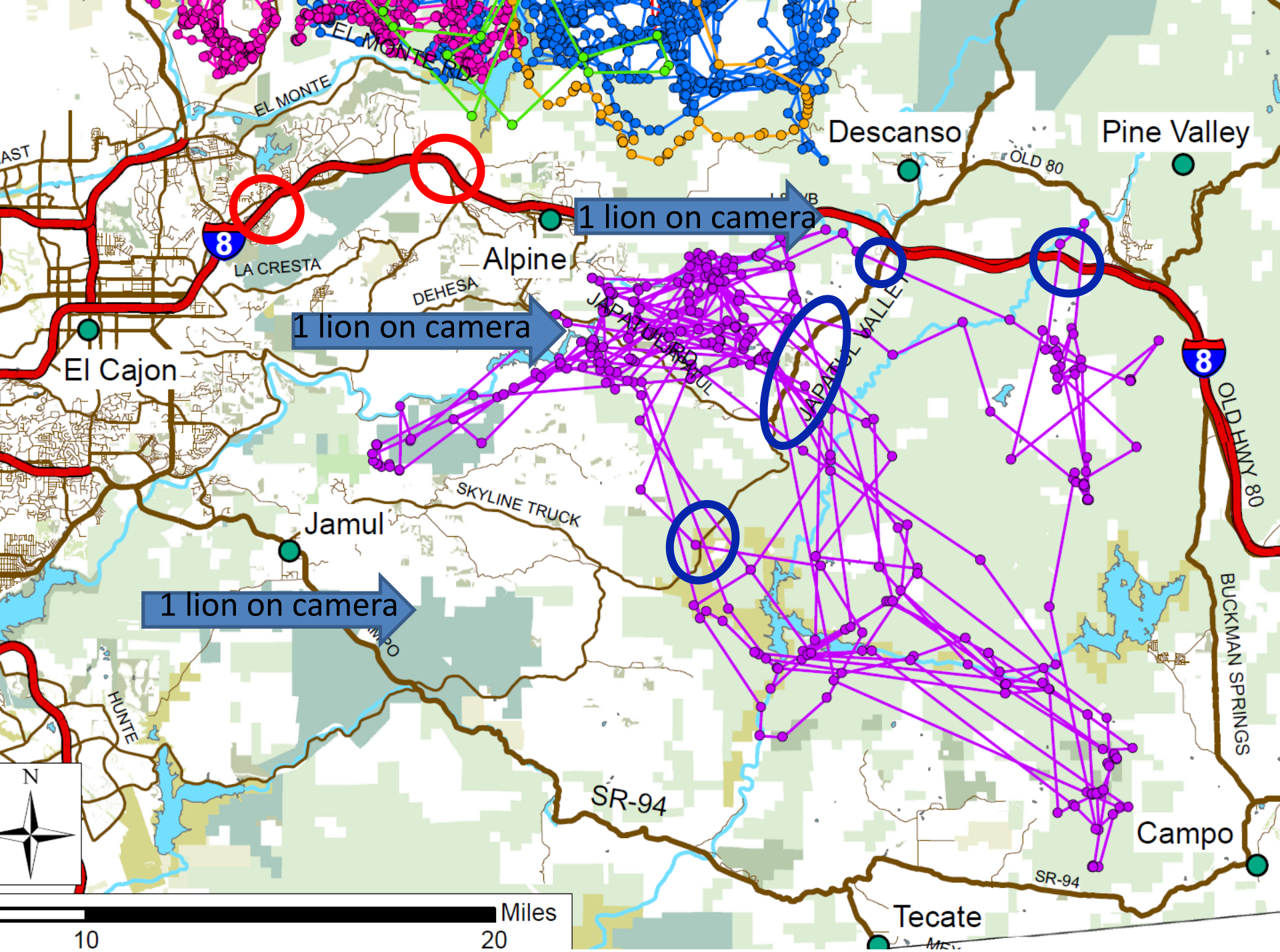
1 lion on camera
1 lion on camera
1 lion on camera
Alpine
Descanso
Pine Valley
El Cajon
Jamul
LA CRESTA
DEHESA
JAPATUL ROAD
JAPATUL VALLEY
SKYLINE TRUCK
OLD 80
OLD HWY 80
BUCKMAN SPRINGS
SR-94
SR-94
Campo
Tecate
EL MONTE
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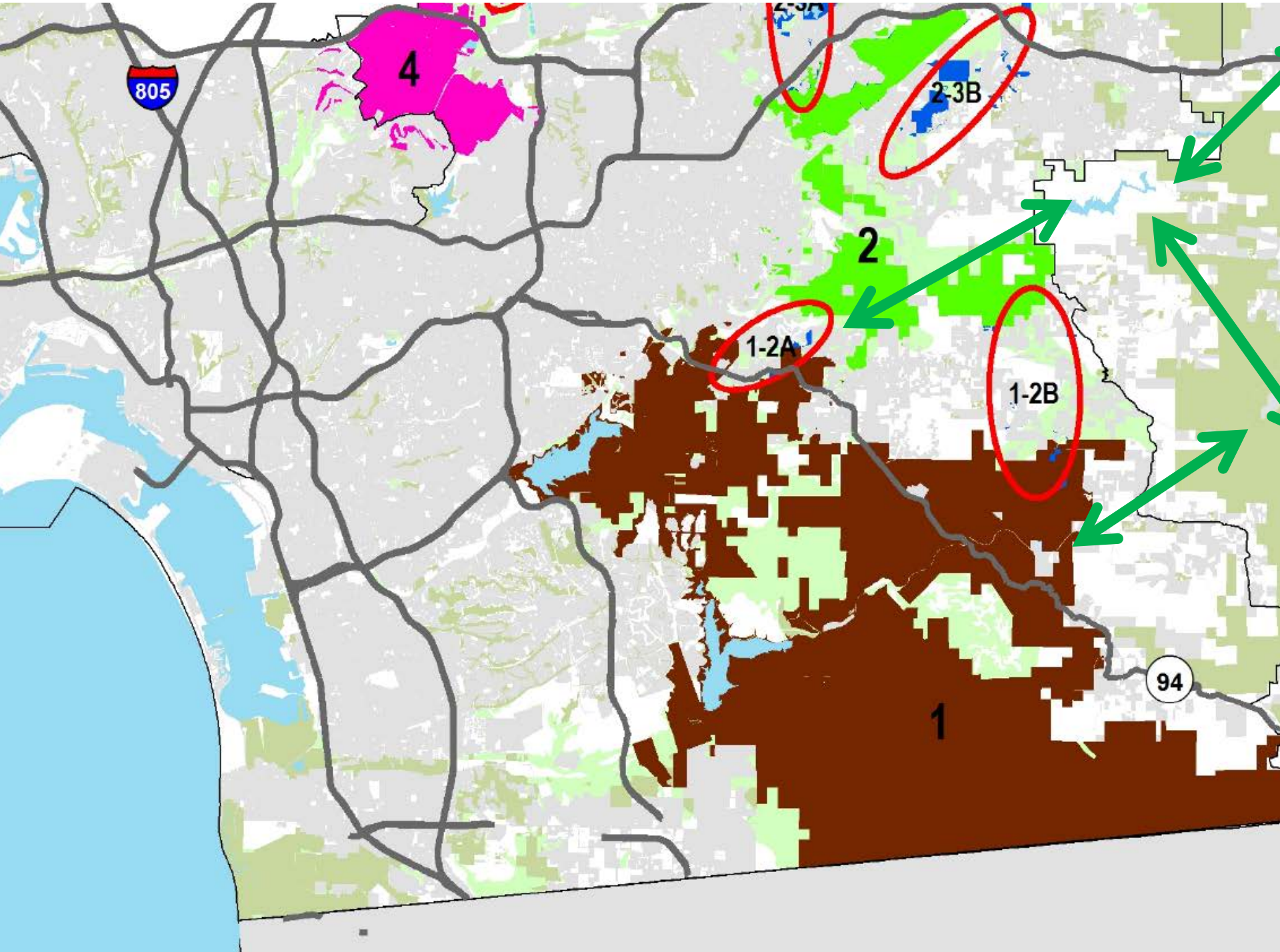

805
4
2-3B
2
1-2A
1-2B
1
94

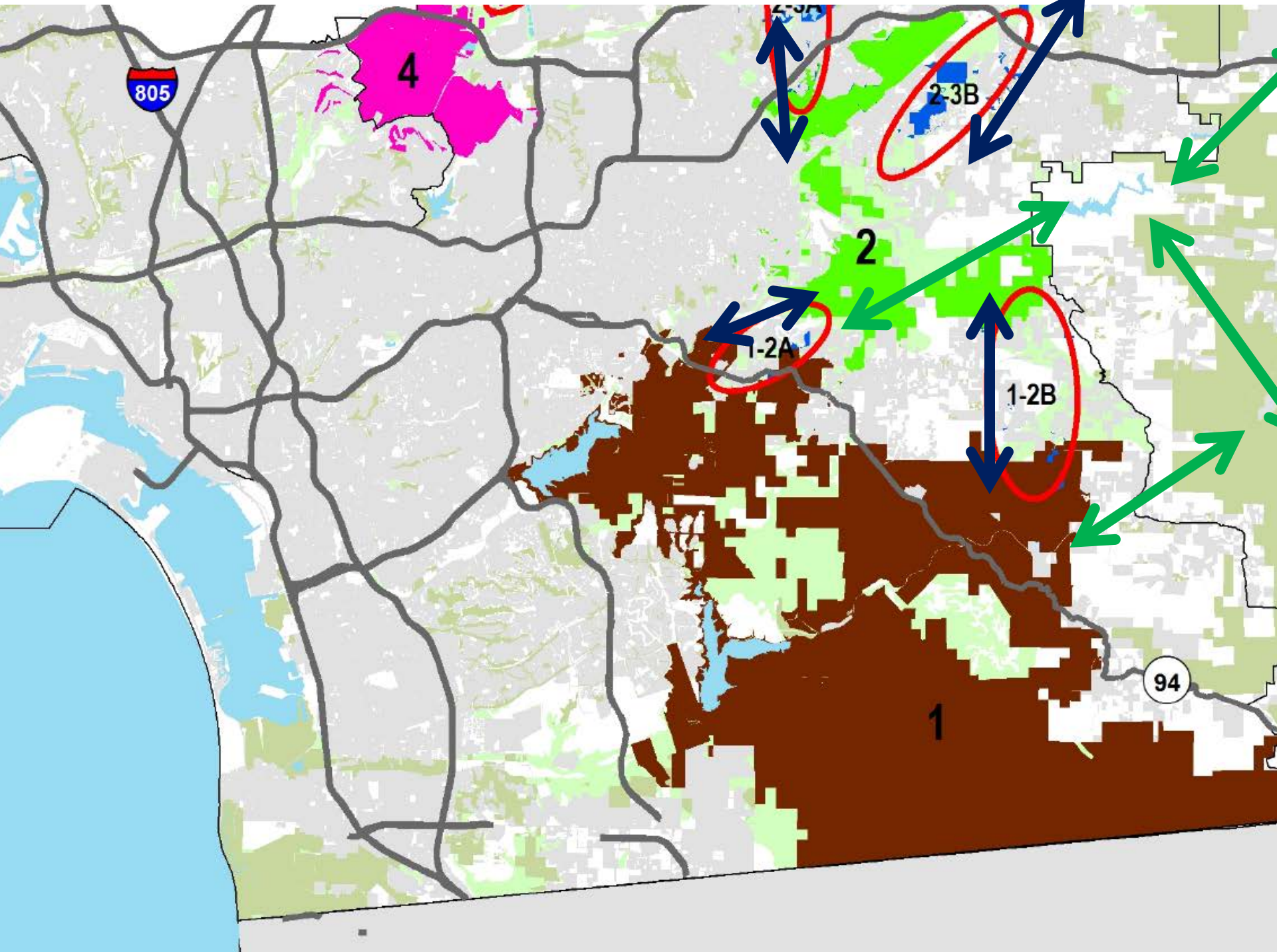
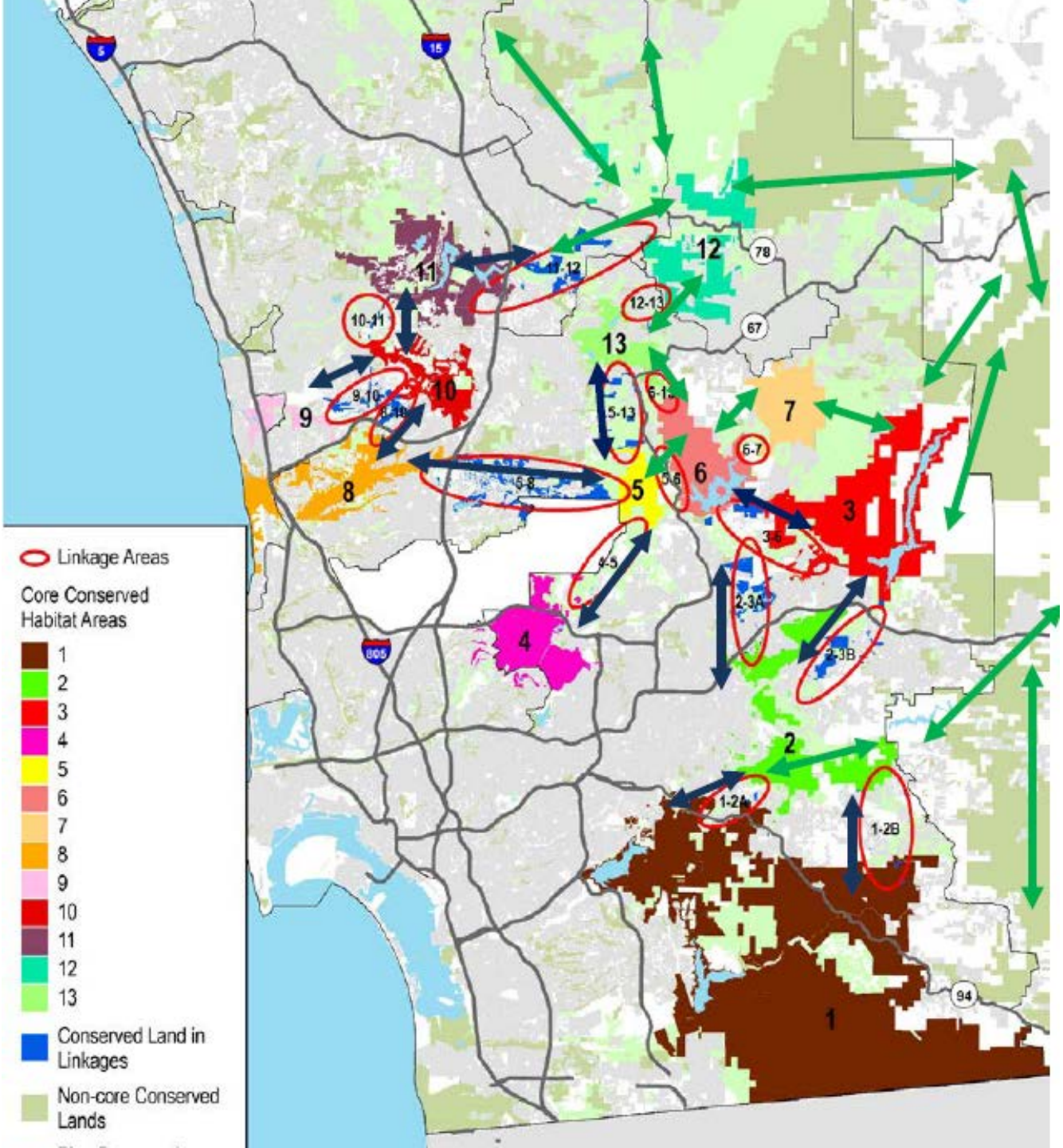

805
4
2-3A
2-3B
2
1-2A
1-2B
1
94

Table 2. Core Conserved Areas and Linkages evaluated by UCD team (blue) and results

Core Conserved Area	Utilized by mountain lions in this study	Linkages	Utilized by mt. lions in this study
1. Hollenbeck-Otay	No (but some historical use)	1-2A 1-2B	No No
2. Crestridge-Cleveland Nat. For.-Sycuan Peak	Yes (southern and eastern portions)	2-3A 2-3B	No No
3. El Capitan reservoir-Cleveland National Forest	Yes	3-6	No
4. Mission Trails	No	4-5	No
5. Sycamore Canyon	Yes (briefly eastern section)	5-6 5-8 5-13	Yes (1 time) No No
6. San Vicente reservoir-Boulder Oaks-San Vicente Highlands	Yes	6-7 6-13	Yes Yes
7. Canada de San Vicente	Yes	7-3 (not prev. ID'd	Yes
8. Penasquitos-Deer Canyon	No (but one mountain lion killed by car in this core in 2011 – was a dispersal age male with genetic signature suggesting origin west of I-15	8-10	No
9. Del Mar Heights area	No	9-10	No
10. Black Mountain	No	10-11	No
11. Lake Hodges	No	11-12	Partial – section east of I-15
12. Boden Canyon-Pamo Valley area	Yes	12-13	Yes
13. Mt. Woodson-Blue Sky Ecological Reserve area	Yes		


Linkage Areas
Core Conserved Habitat Areas
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13
Conserved Land in Linkages
Non-core Conserved Lands
1-2
1-2B
2-3A
2-3B
3-6
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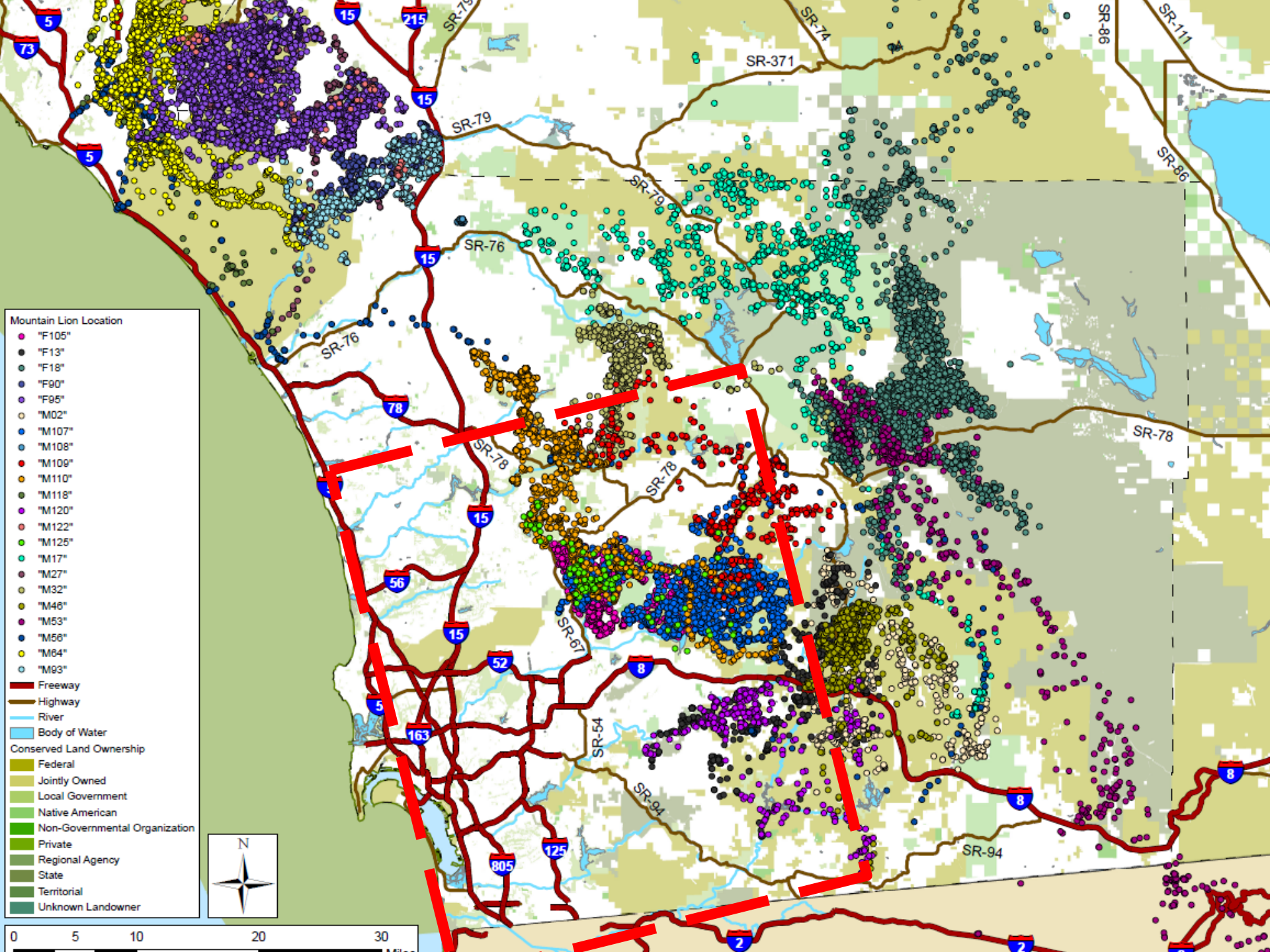
Mountain Lion Location
"F105"
"F13"
"F18"
"F90"
"F95"
"M02"
"M107"
"M108"
"M109"
"M110"
"M118"
"M120"
"M122"
"M125"
"M17"
"M27"
"M32"
"M46"
"M53"
"M56"
"M64"
"M93"
Freeway
Highway
River
Body of Water
Conserved Land Ownership
Federal
Jointly Owned
Local Government
Native American
Non-Governmental Organization
Private
Regional Agency
State
Territorial
Unknown Landowner
N
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SR-371
SR-79
SR-76
SR-78
SR-67
SR-54
SR-94
SR-74
SR-86
SR-111


Mountain Lion MCP
"F105"
"F13"
"F18"
"F90"
"F95"
"M02"
"M107"
"M108"
"M109"
"M110"
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Freeway
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River
Body of Water
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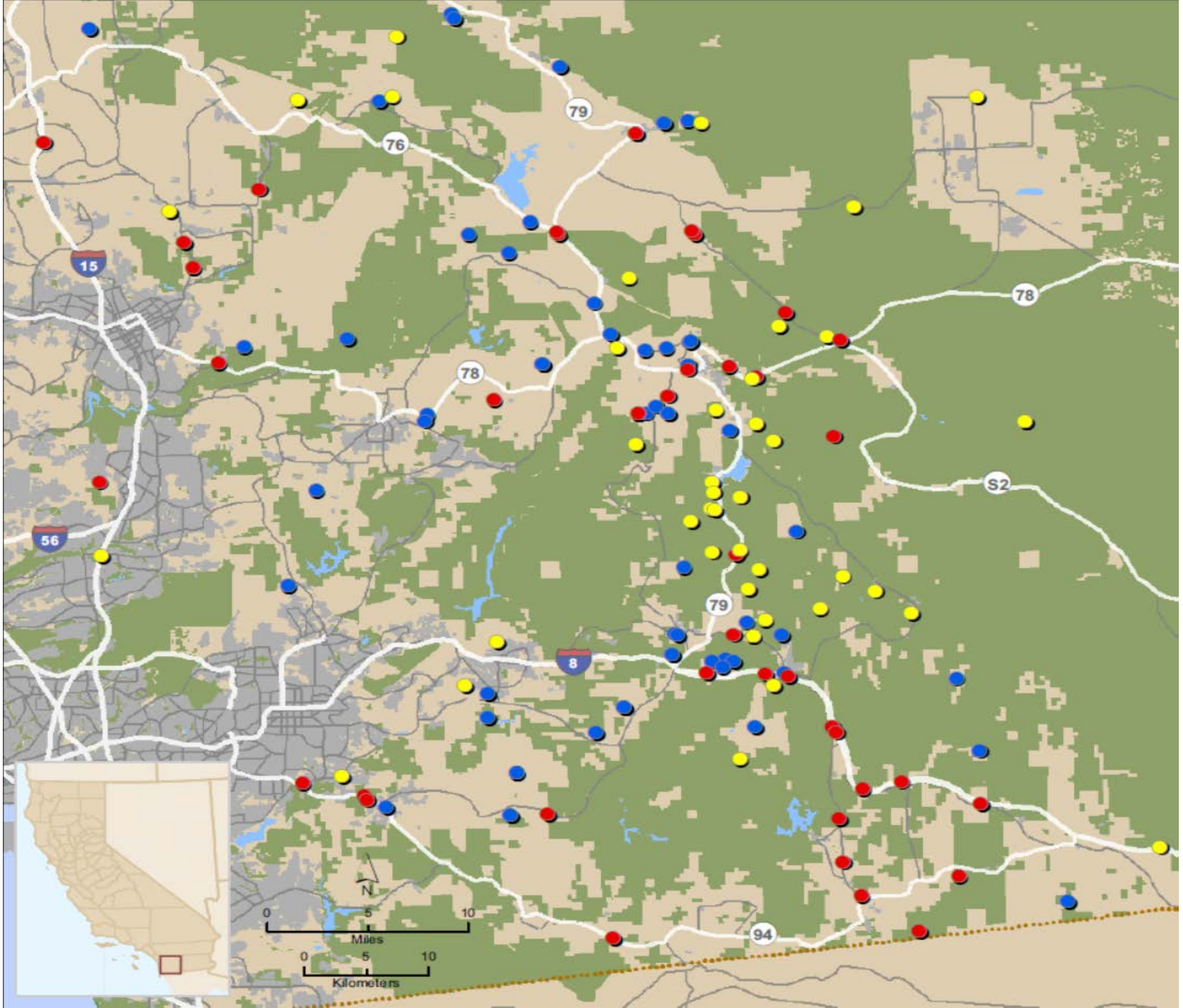
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Miles
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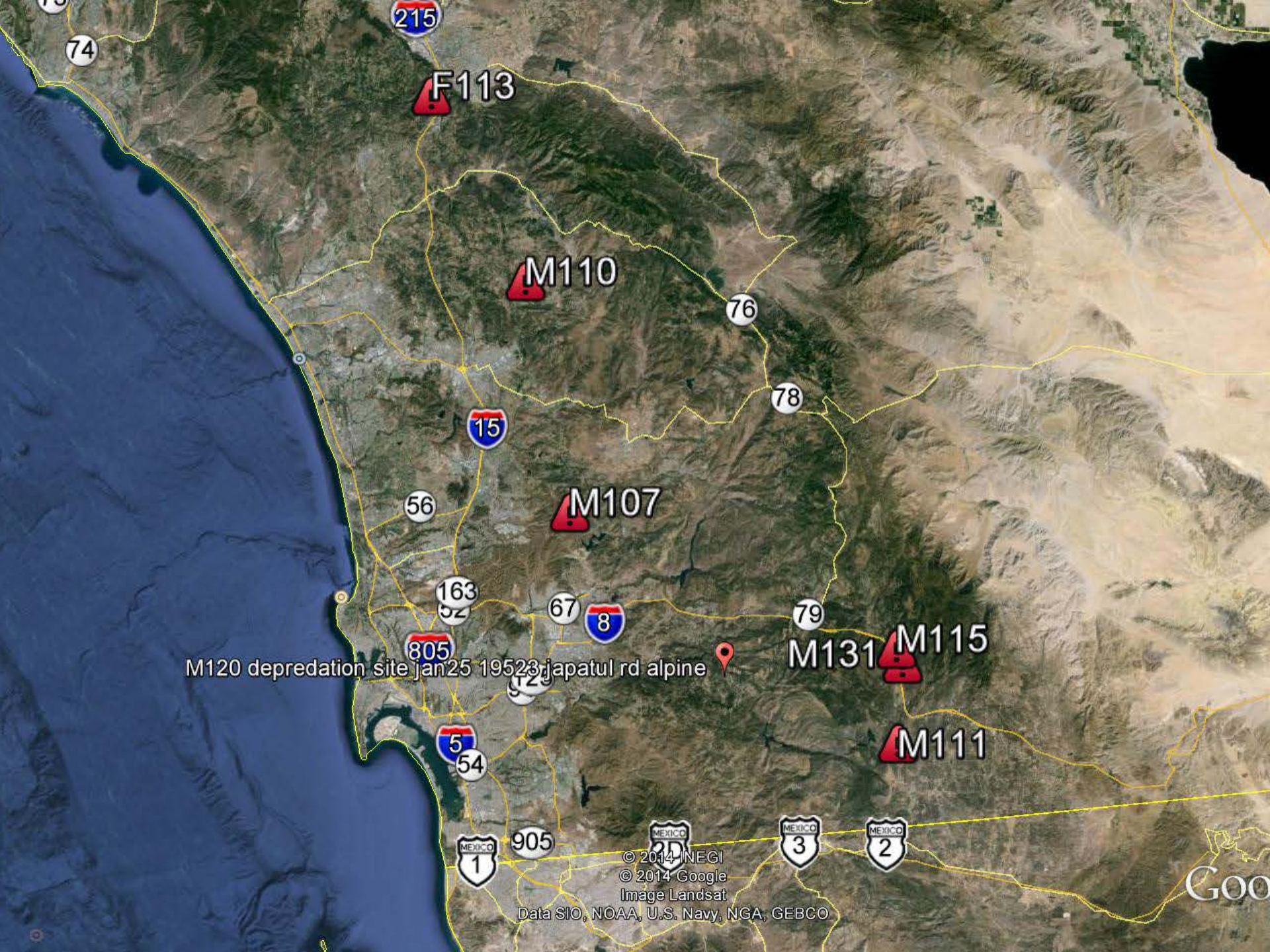
Kilometers

During study period 10 other pumas were killed by cars or on depredation permits in the county, and 1 died of disease

Annual survival rates in our study (both east and west of I-15) are **similar or worse than heavily hunted populations**

It is ironic that states that hunt these animals do a better job preserving them than we do


F113
M110
M107
M120 depredation site jan25 19523 japatul rd alpine
M131
M115
M111
215
74
76
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56
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67
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805
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1
2D
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2
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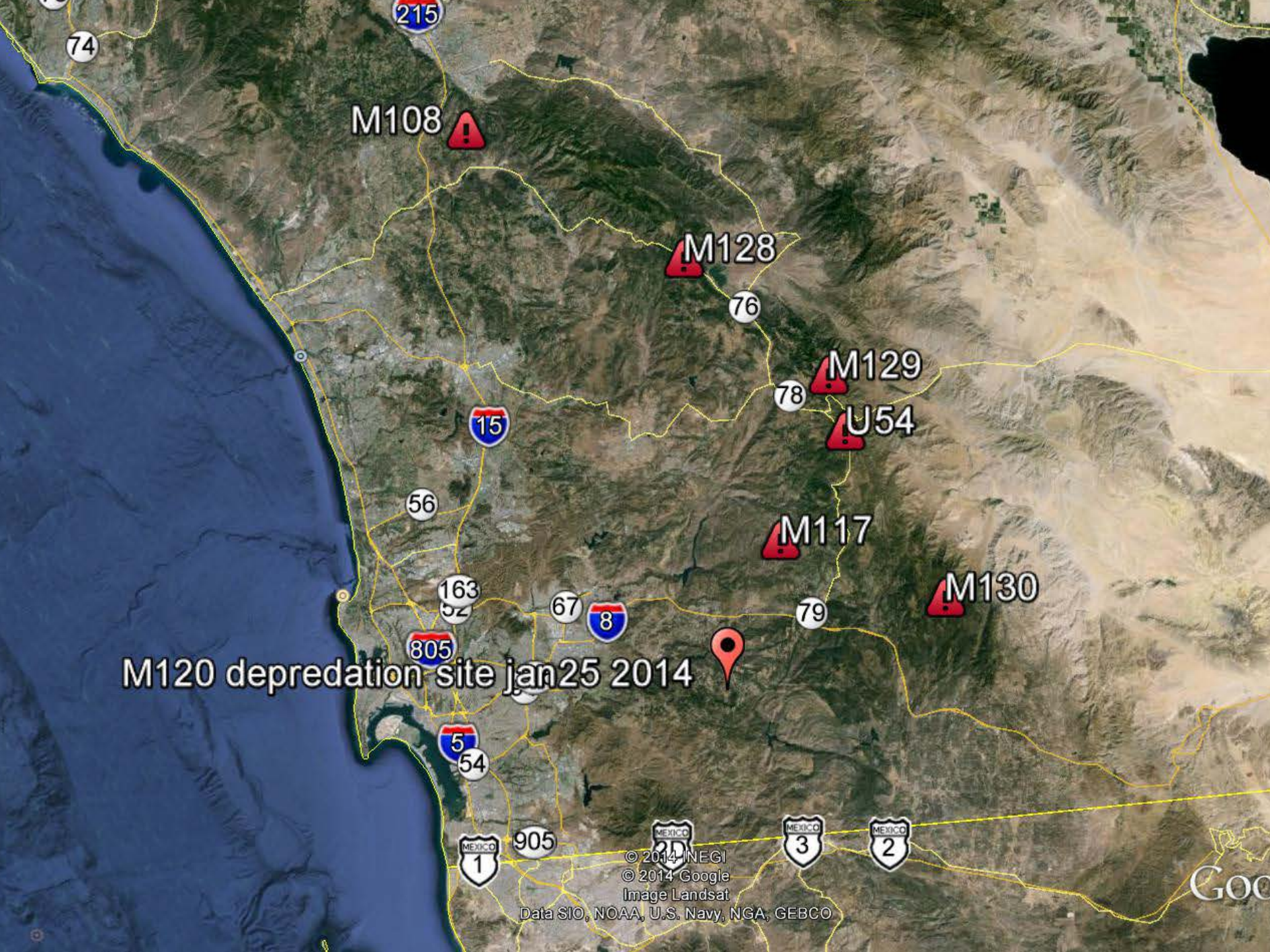
Image Landsat
Data SIO, NOAA, U.S. Navy, NGA, GEBCO


M108
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M120 depredation site jan25 2014
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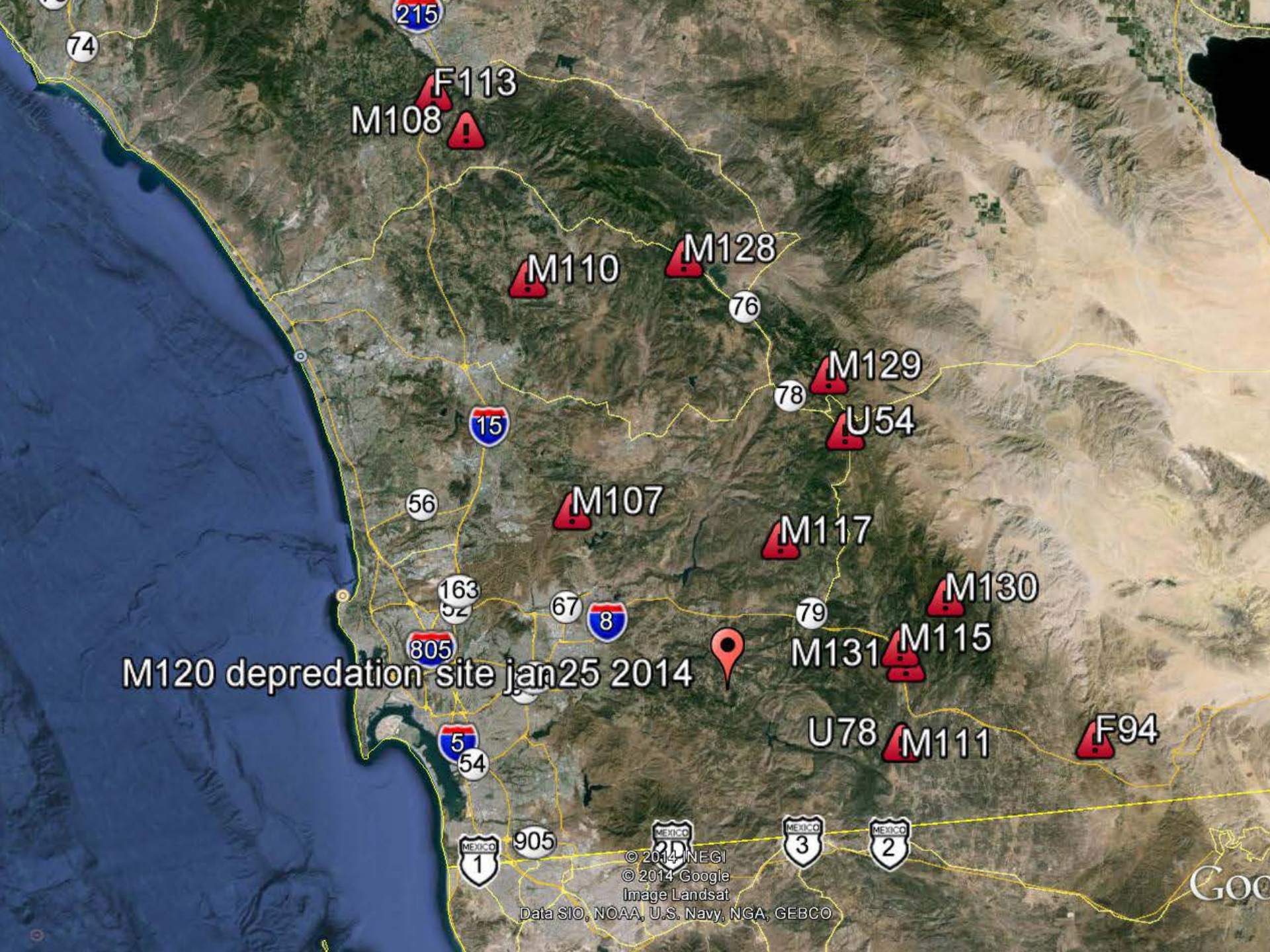
F113
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M120 depredation site jan 25 2014
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M111
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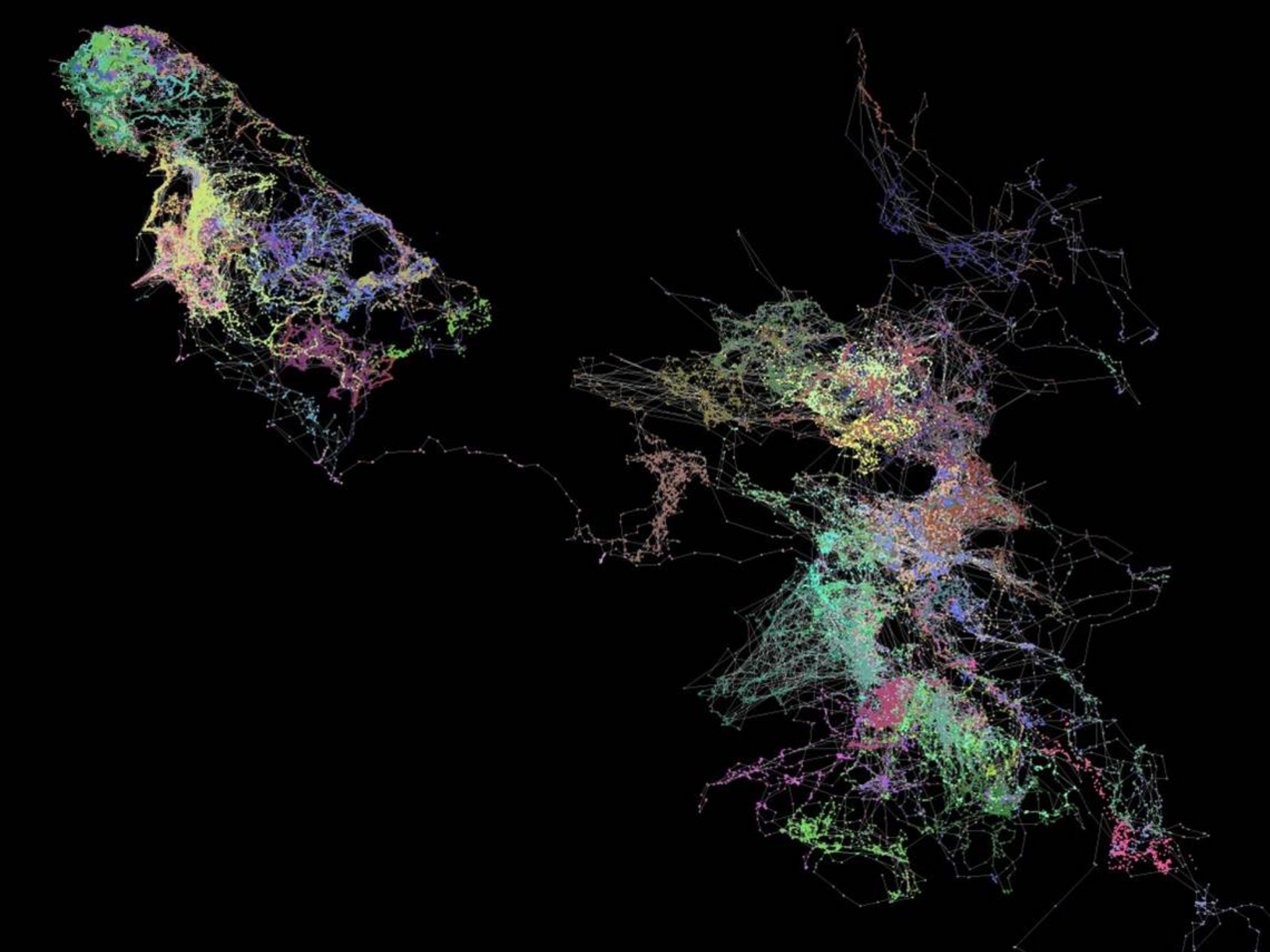
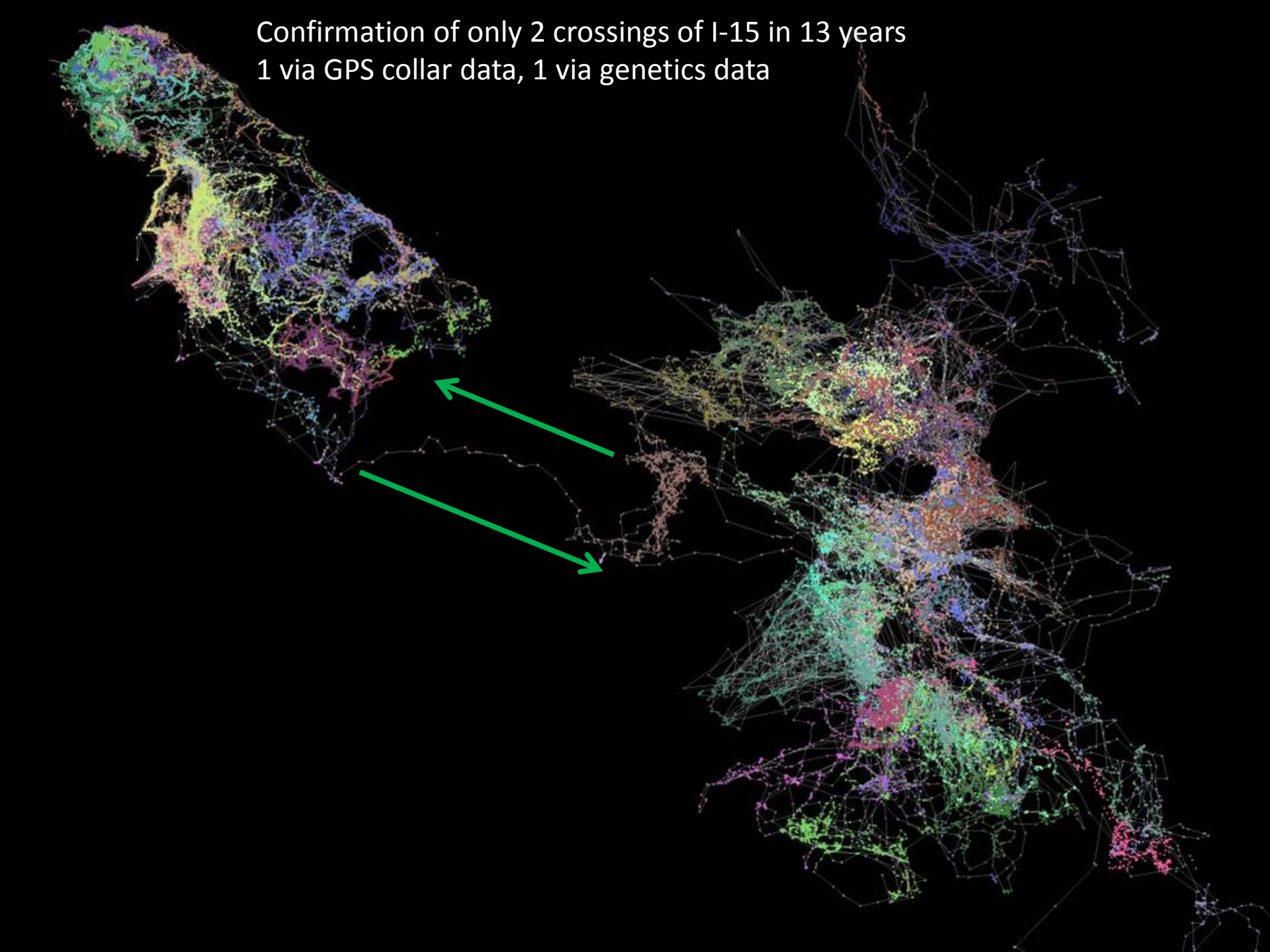
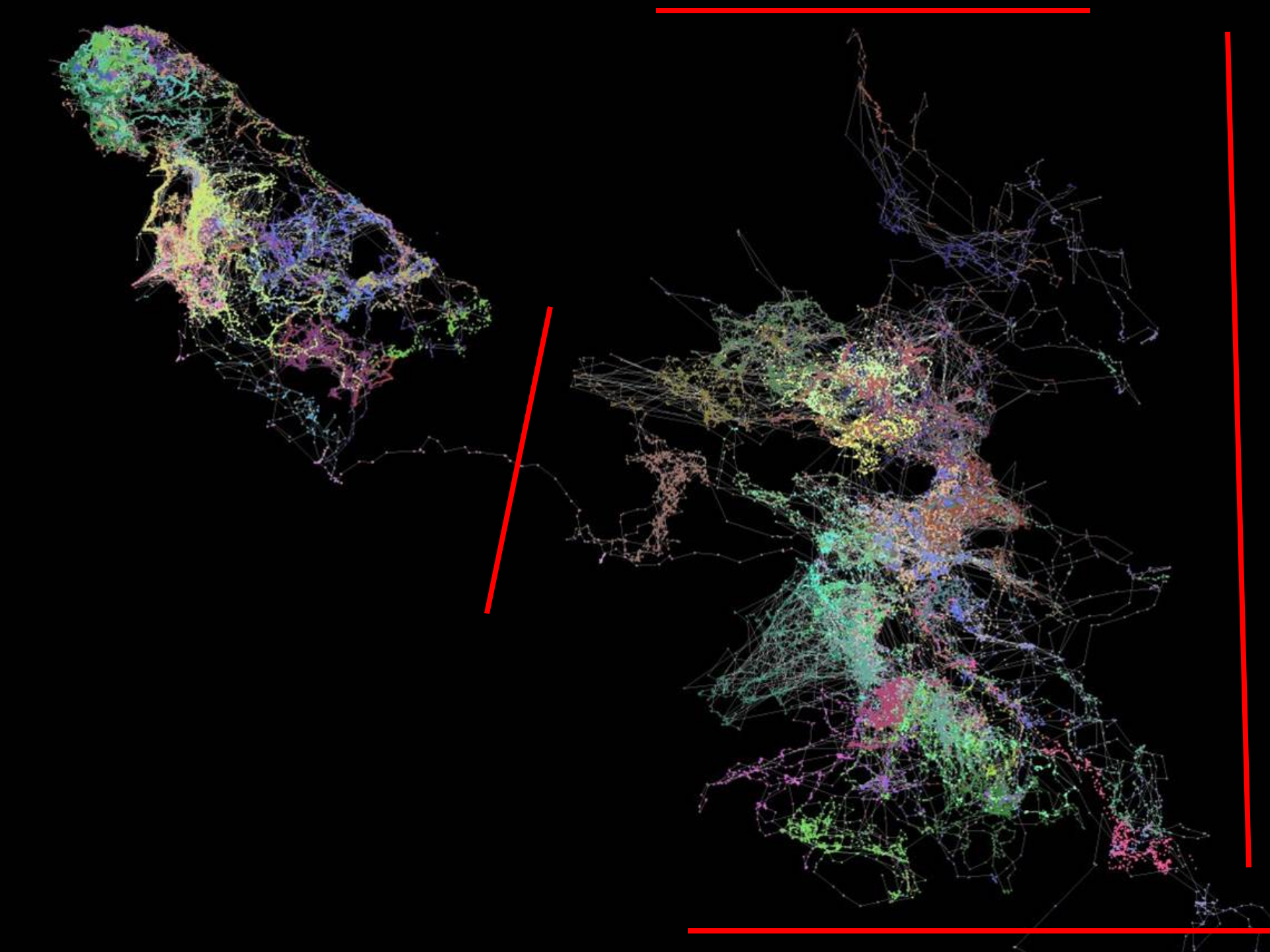



Confirmation of only 2 crossings of I-15 in 13 years
1 via GPS collar data, 1 via genetics data



Legend

Santa Cruz Mtns (N. Central Coast)

Monterey-San Luis Obispo Co (C. Central Coast)

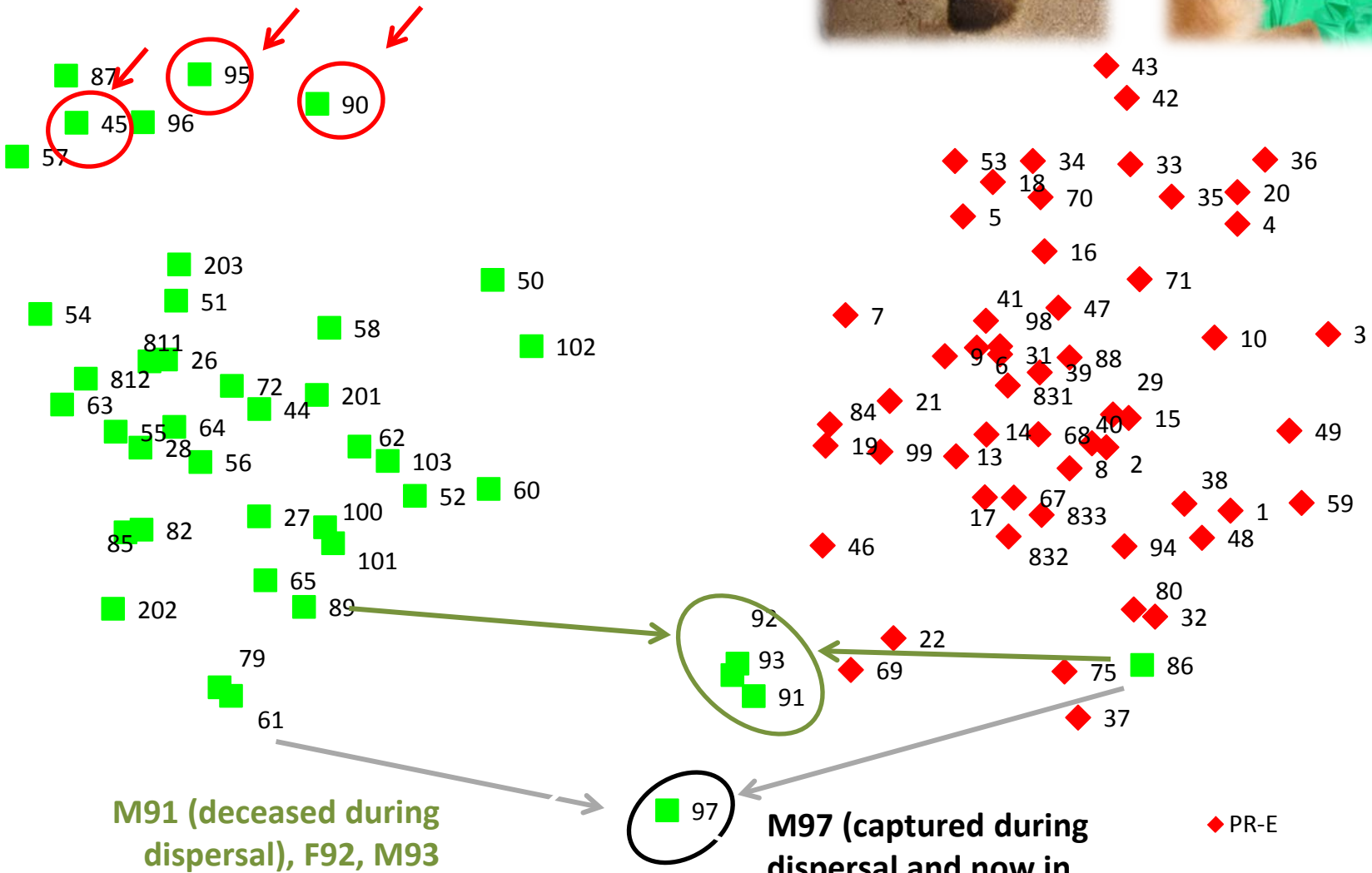
Santa Monica Mountains (S. Central Coast)

Peninsular Range-east

Santa Ana Mountains

San Bernardino County

Resident females adjacent to I-15 west of Temecula

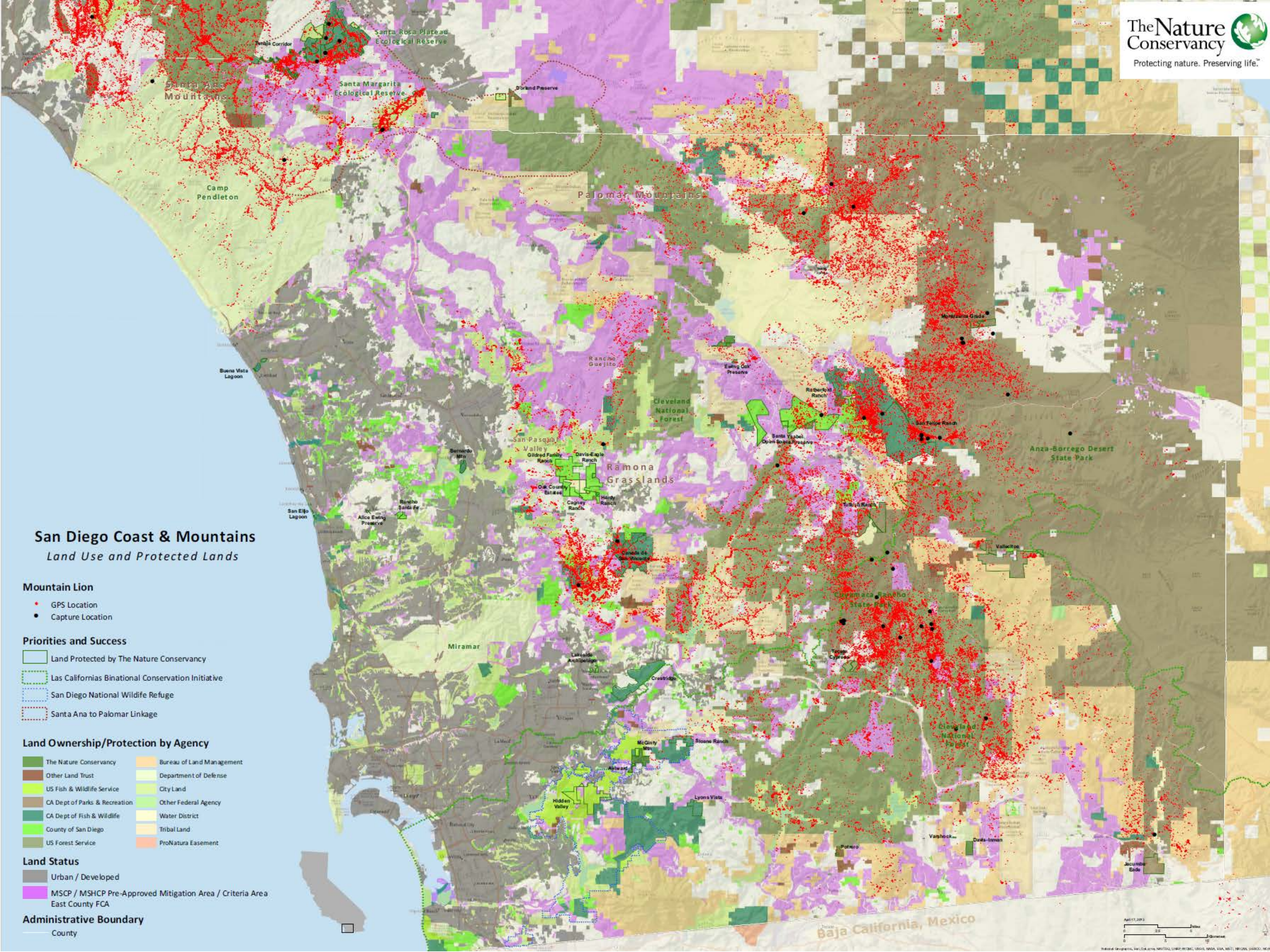


Distinct genetic bottleneck Santa Ana Mountains

	Mode	IAM P value	TPM P value	Ne Eff. Pop Size (Confid. Interval)
Santa Ana Mtns	**Shifted mode**	**0.0001**	**0.009**	**5.1** (3.3-6.7)
Peninsular Range, East	Normal L	0.003	0.19	**24.3** (20.6-28.8)

p-values for population bottleneck tests (Wilcoxon sign-rank test; BOTTLENECK) Infinite Alleles Model (IAM) and two-phase (TPM) models of microsatellite evolution

Effective population size - point estimate linkage disequilibrium method of (LDNE, Waples 2006) with 95% confidence intervals (CI) for both parametric (P) and jackknifed (JK) estimates.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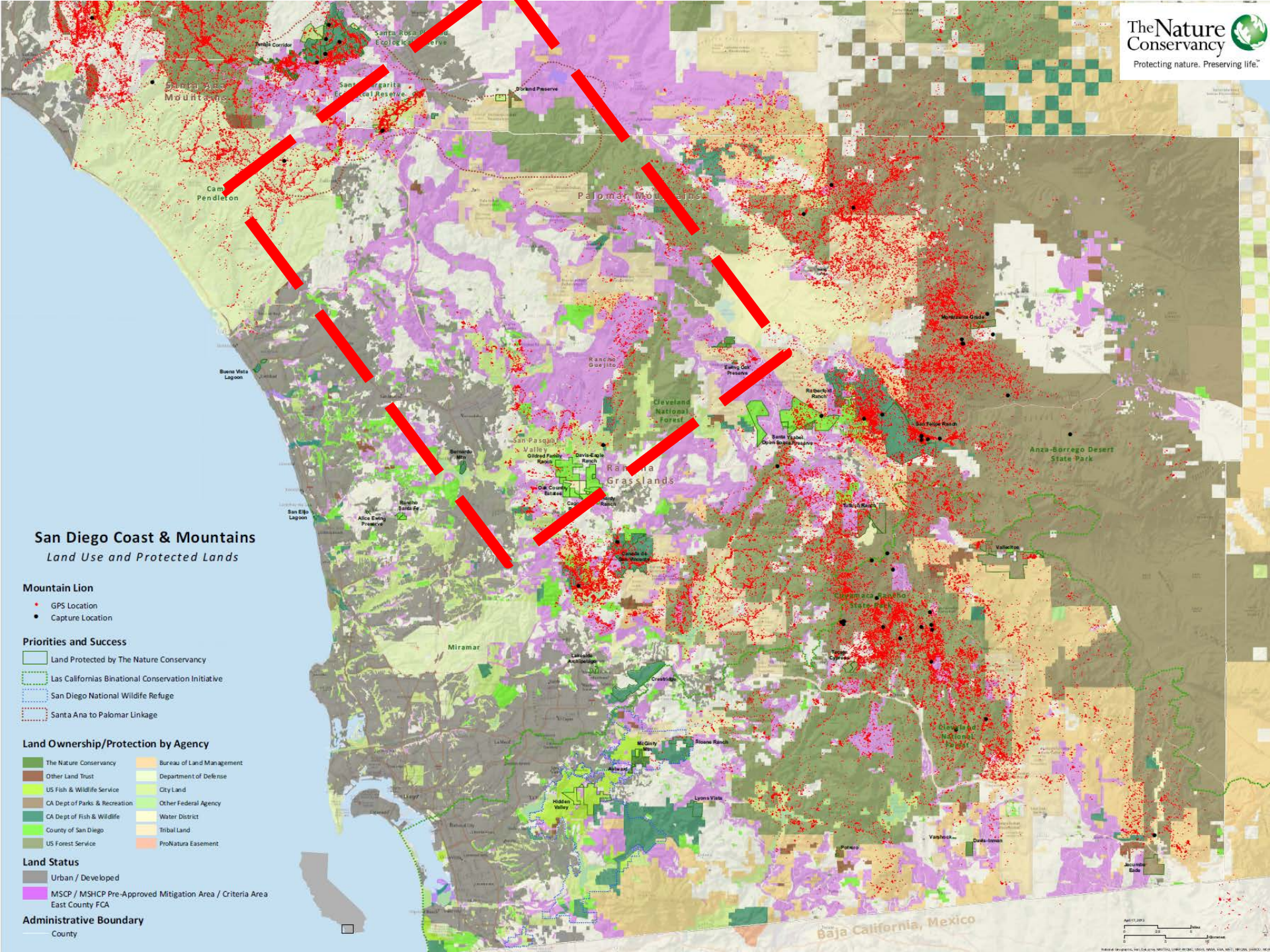
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Urban / Developed
MSCP / MSHCP Pre-Approved Mitigation Area / Criteria Area
East County FCA
Administrative Boundary
County

Santa Ana Mountain pumas had high average pairwise relatedness, high individual internal relatedness, a low estimated effective population size, and strong evidence of a bottleneck and isolation from other populations in California. These and ecological findings provide clear evidence that Santa Ana Mountain pumas have been experiencing genetic impacts related to barriers to gene flow, and **are a warning signal to wildlife managers and land use planners that mitigation efforts will be needed to stem further genetic and demographic decay in the Santa Ana Mountains puma population.**

Despite warnings from Beier et al. (1995) and Ernest et al. (2003) about potential serious impacts to the Santa Ana Mountains puma population if concerted conservation action was not taken, habitat connectivity to the Peninsular Ranges has continued to erode. We are hopeful that these new genetic results will motivate greater focus on connectivity conservation in this region. Indeed, the Santa Ana Mountains pumas may well serve as harbingers of things to come throughout California and the western United States if more attention is not paid to maintaining connectivity for wildlife as development progresses.

Critical linkages