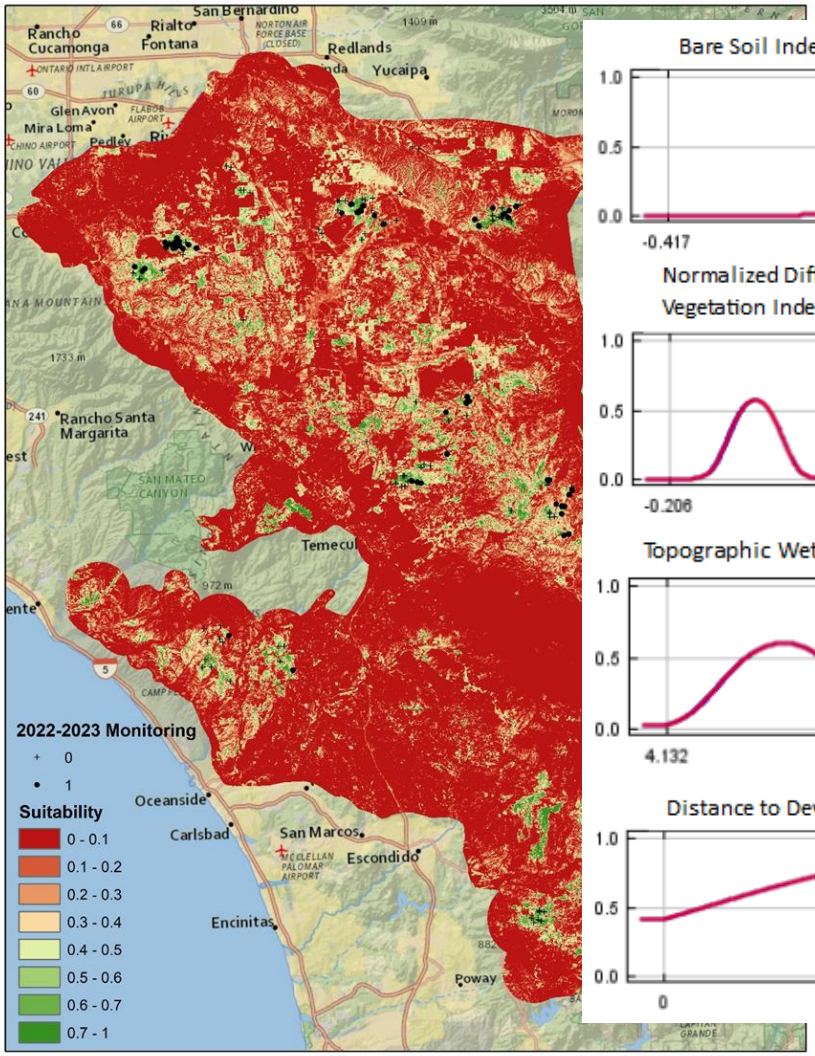
SDMMP SKR Presentation March 2025

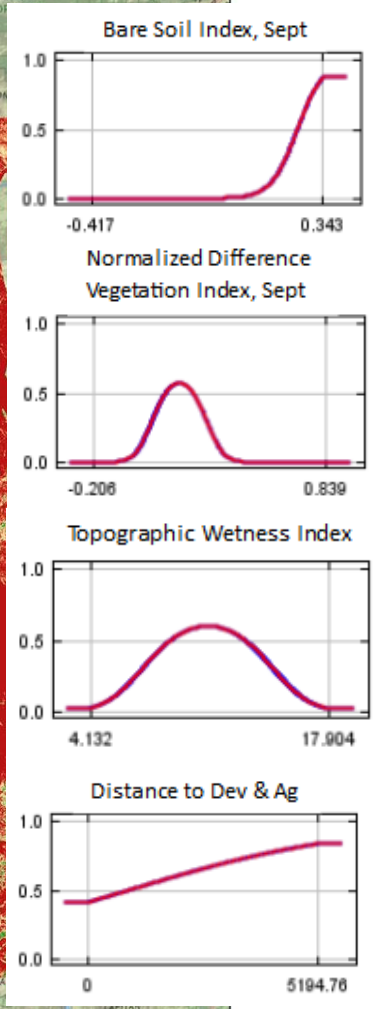
- 2024 SKR habitat model
- Monitoring sample frame
- Monitoring results 2022-2024
- Gaps in monitoring coverage
- Proposed SKR translocation into Ramona Grasslands

2024 SKR HABITAT MODEL

- A statistical (Maxent) SKR habitat value model using:
  - SKR capture data, 2004-present
  - Environmental variables averaged over 20 years, 2003-2023
  - Including satellite imagery (30m resolution)

Type	Variable
LANDSAT VEG & SOIL INDICES 2003-2023 3 Versions: April September September - April	Bare Soil Index
	Clay Minerals Ratio
	Normalized Difference Texture Index
	Normalized Difference Sand Dune Index
	Soil Composition Index
	Soil Adjusted Vegetation Index
	Topsoil Grain Size Index
	Tasselled Cap Brightness
	Enhanced Bloom Index (White)
	Enhanced Vegetation Index
	Normalized Difference Drought Index (Alternate)
	Normalized Difference Moisture Index
	Normalized Difference Vegetation Index
	Tasselled Cap Greenness
	Tasselled Cap Wetness
TOPO	Elevation
	Slope
	Flow Accumulation
	Topographic Wetness Index
Development/Agriculture	Distance to Development
	Distance to Development & Agriculture
CLIMATE (1991-2020)	Annual Heat-Moisture Index
	Precipitation, May - September
	Precipitation, June - August
	Precipitation, March - May
	Summer Heat-Moisture Index

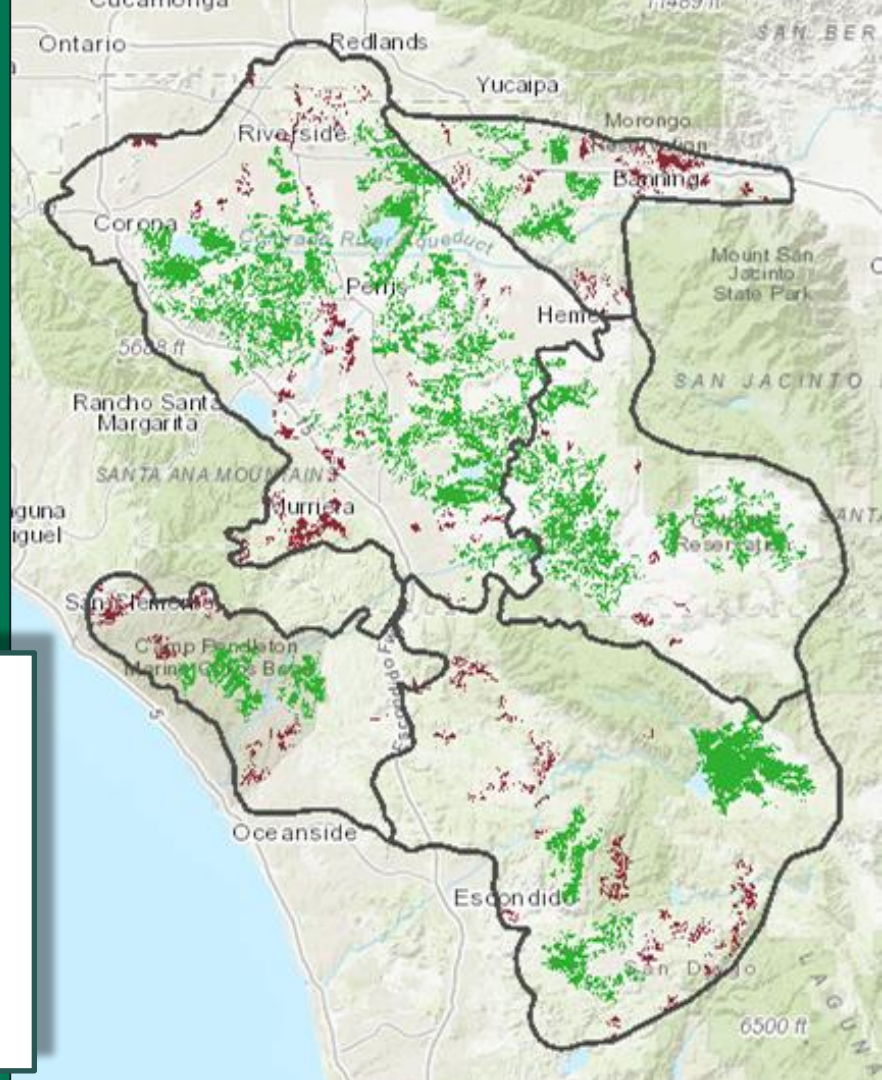




Predictors	Mean Permutation Importance
Bare Soil Index, September	46.9
Normalized Difference Vegetation Index, September	23.6
Topographic Wetness Index	13.8
Distance to Development & Agriculture	6.2
Soil Composition Index, April	2.7
Normalized Difference Vegetation Index, Sept - April	2.3
Tasseled Cap Brightness, September	2.1
Precipitation, June - August	2.0
Annual Heat-Moisture Index	0.6

SKR Habitat Suitability, 2024

- Identifies areas suitable to support SKR populations.
- Uses multispectral satellite imagery averaged over 20 years (2003-2023).
- Can be updated annually.
- Used to identify where monitoring is warranted.



Legend

SKR Monitoring Regions - 2024

Stephens' Kangaroo Rat Population Units (2024 version)

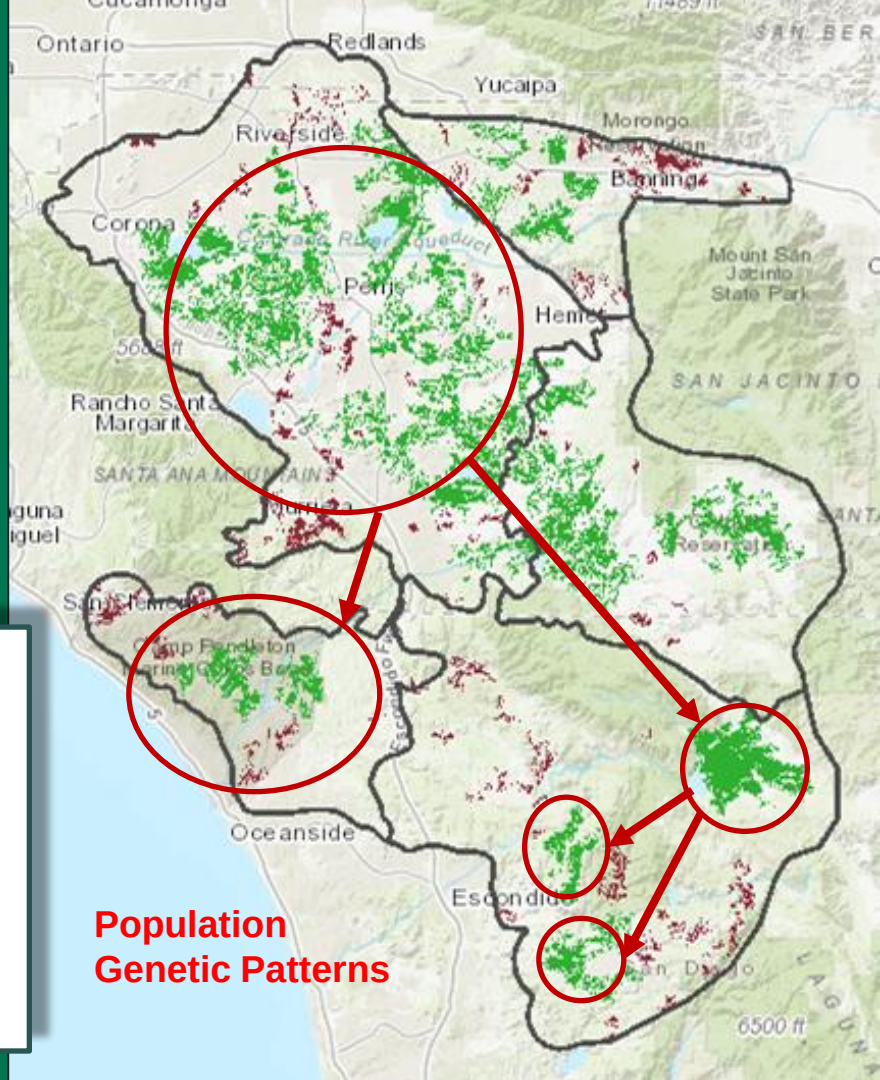
Displaying: **occupancy**

Occupied sometime during 2004 - 2023

Unknown

SKR Habitat Suitability, 2024

- Identifies areas suitable to support SKR populations.
- Uses multispectral satellite imagery averaged over 20 years (2003-2023).
- Can be updated annually.
- Used to identify where monitoring is warranted.



Rangewide Monitoring Program

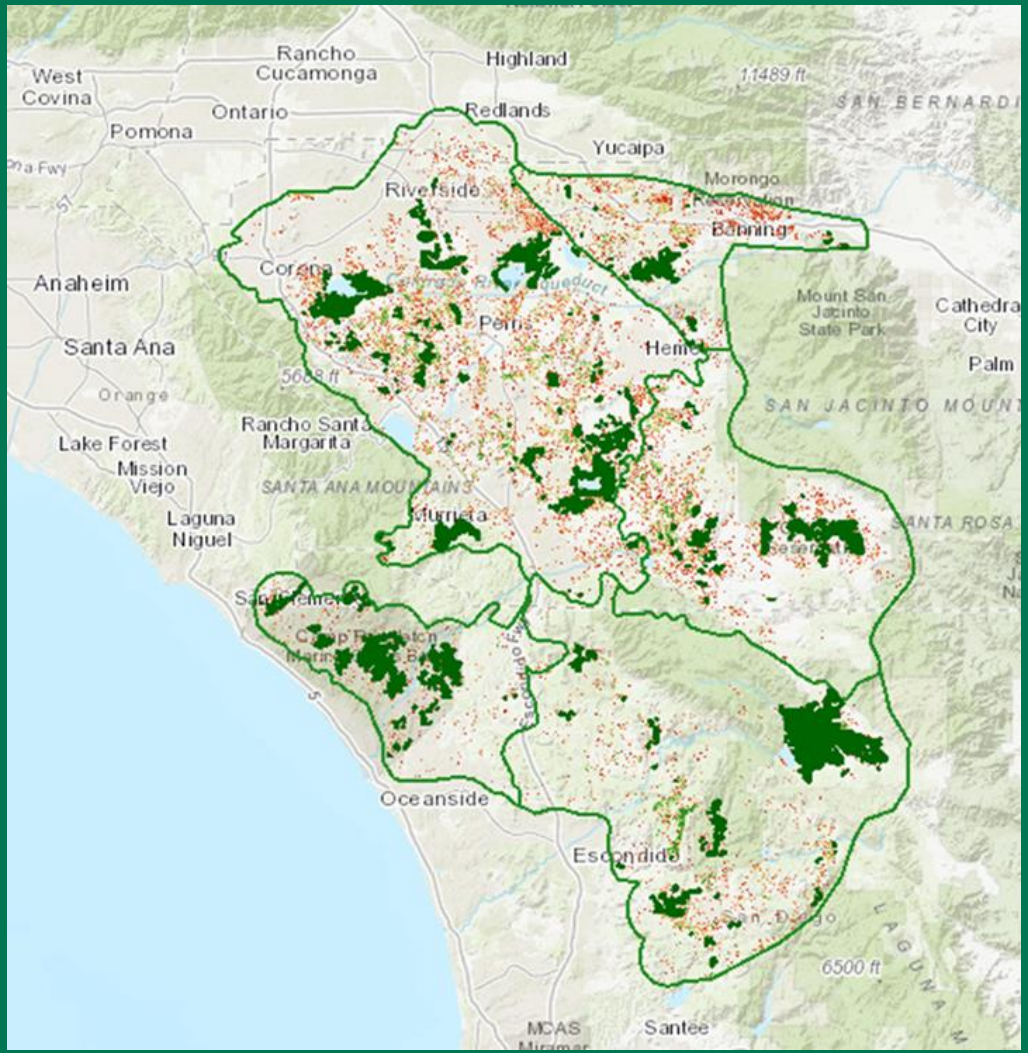
- % Occupancy
- Local density (# unique indivuals captured)

Sampling Frame, 2024

- Thousands of 4-ha sample cells
- Within population units
- On accessible lands (e.g., reserves, military)

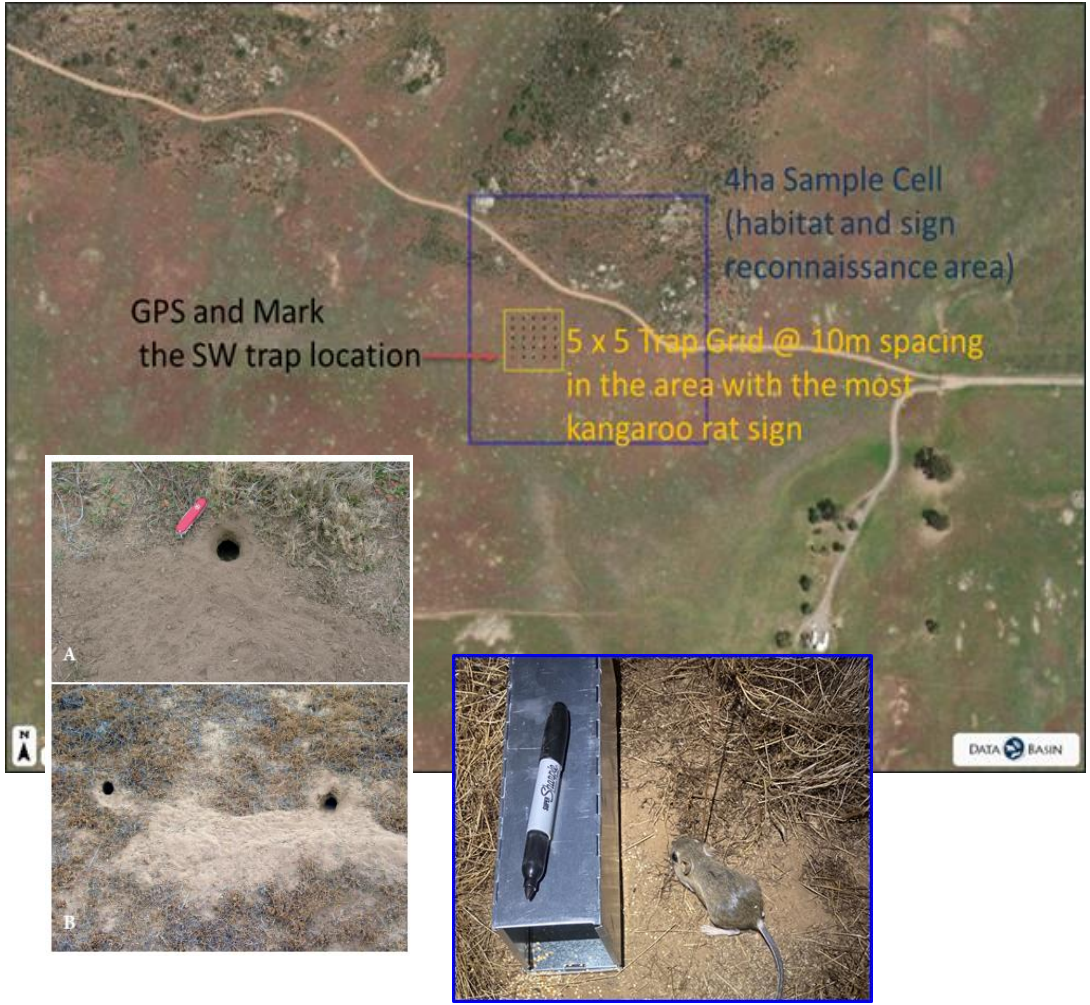
Stratified Random Sampling

- By ecoregion
- Rotating Design
- ~80 cells per year
  - ~2/3 repeat samples from previous year
  - ~1/3 new sites each year



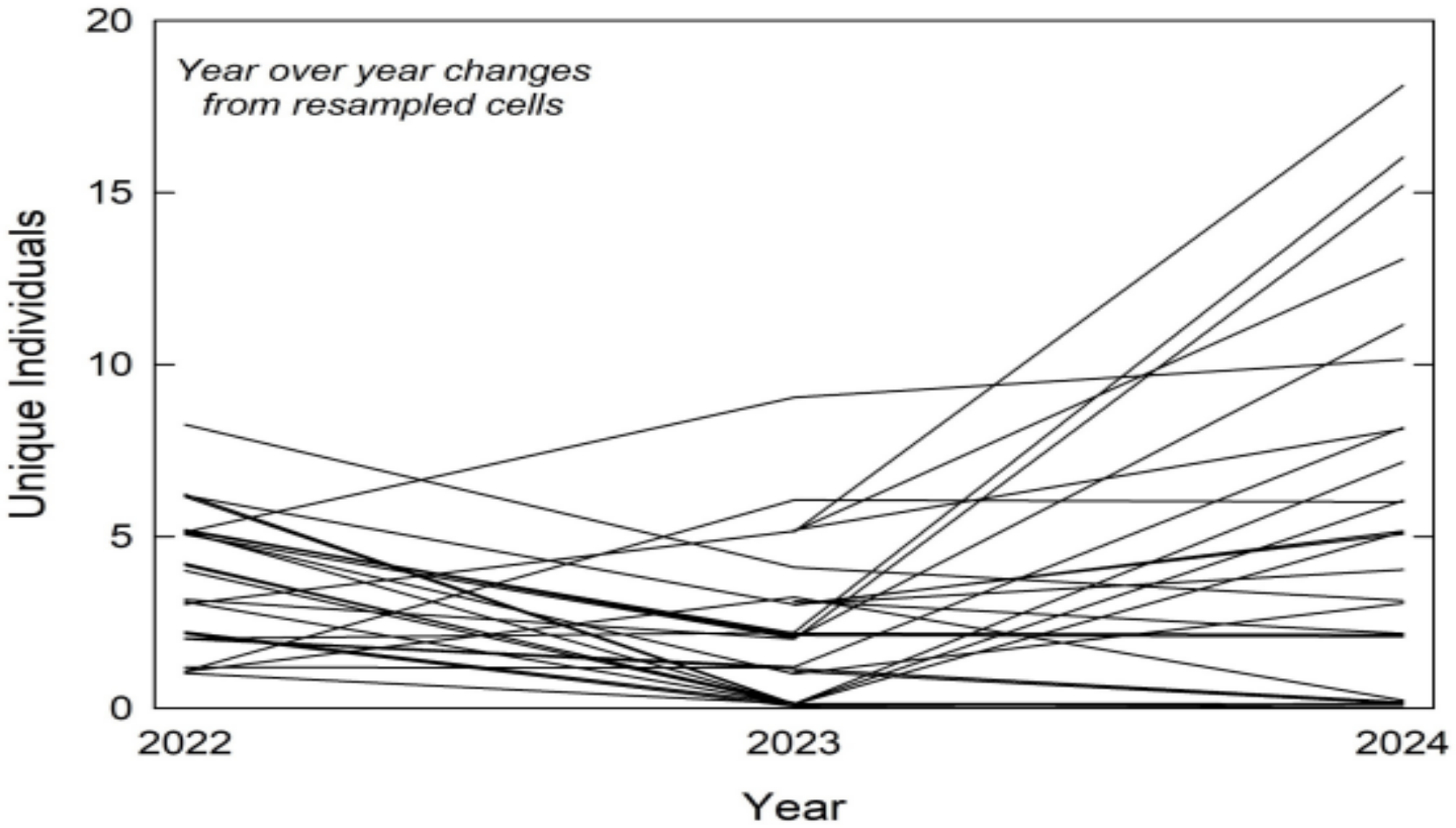
Survey Protocols

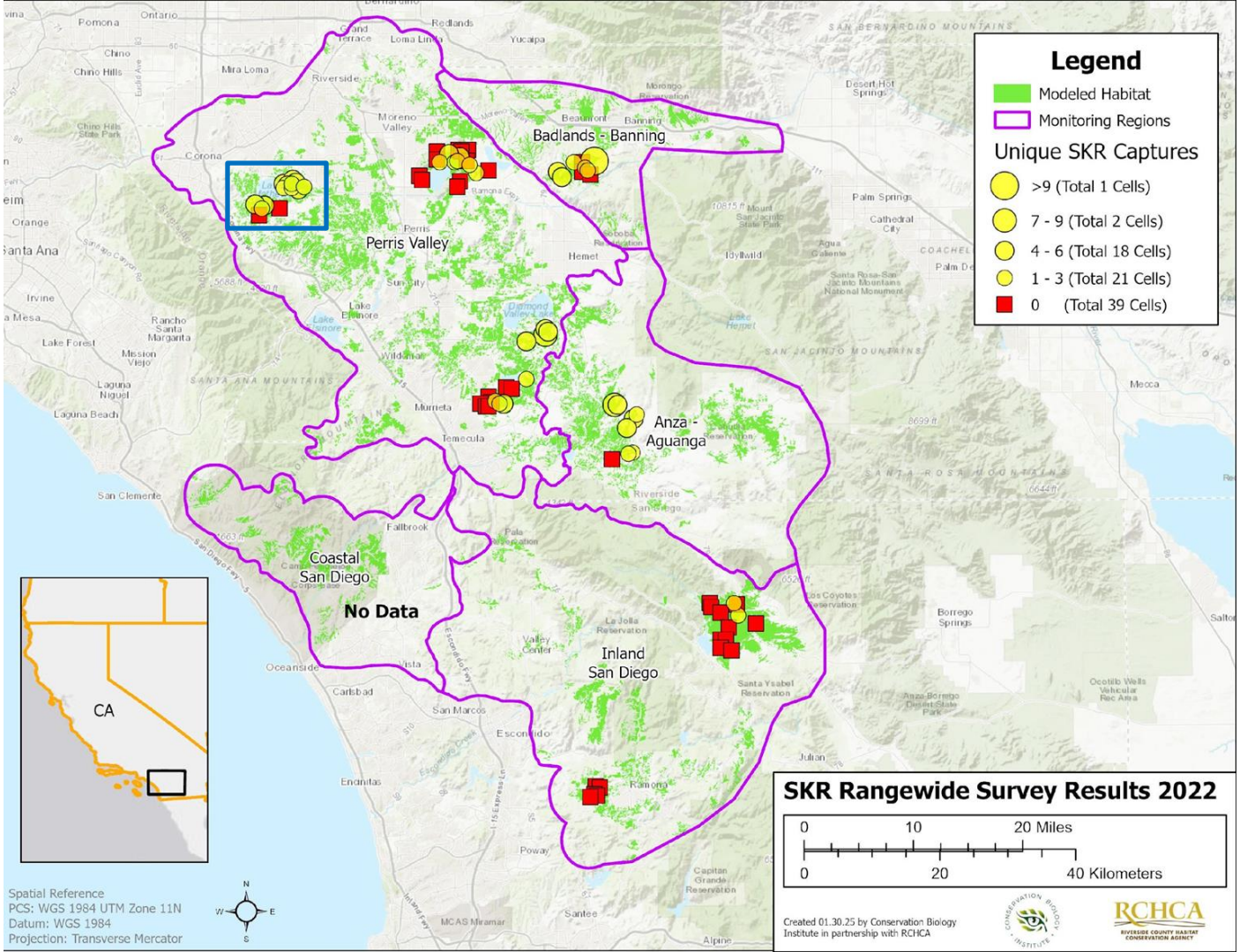
- Reconnaissance survey for krat sign over 4-ha Sample Cell
- If no krat sign, occupancy = 0.
- If krat sign found, establish a 0.25-ha Trap Grid within the 4-ha Sample Cell:
  - 5 x 5 Sherman trap array
  - 10-m spacing
  - In location with highest expected capture probability
  - 2 nights (2x/night) of trapping after 1 night of prebaiting
- Purpose:
  - Confirm species (SKR vs DKR)
  - Local density index
  - Collect genetic samples

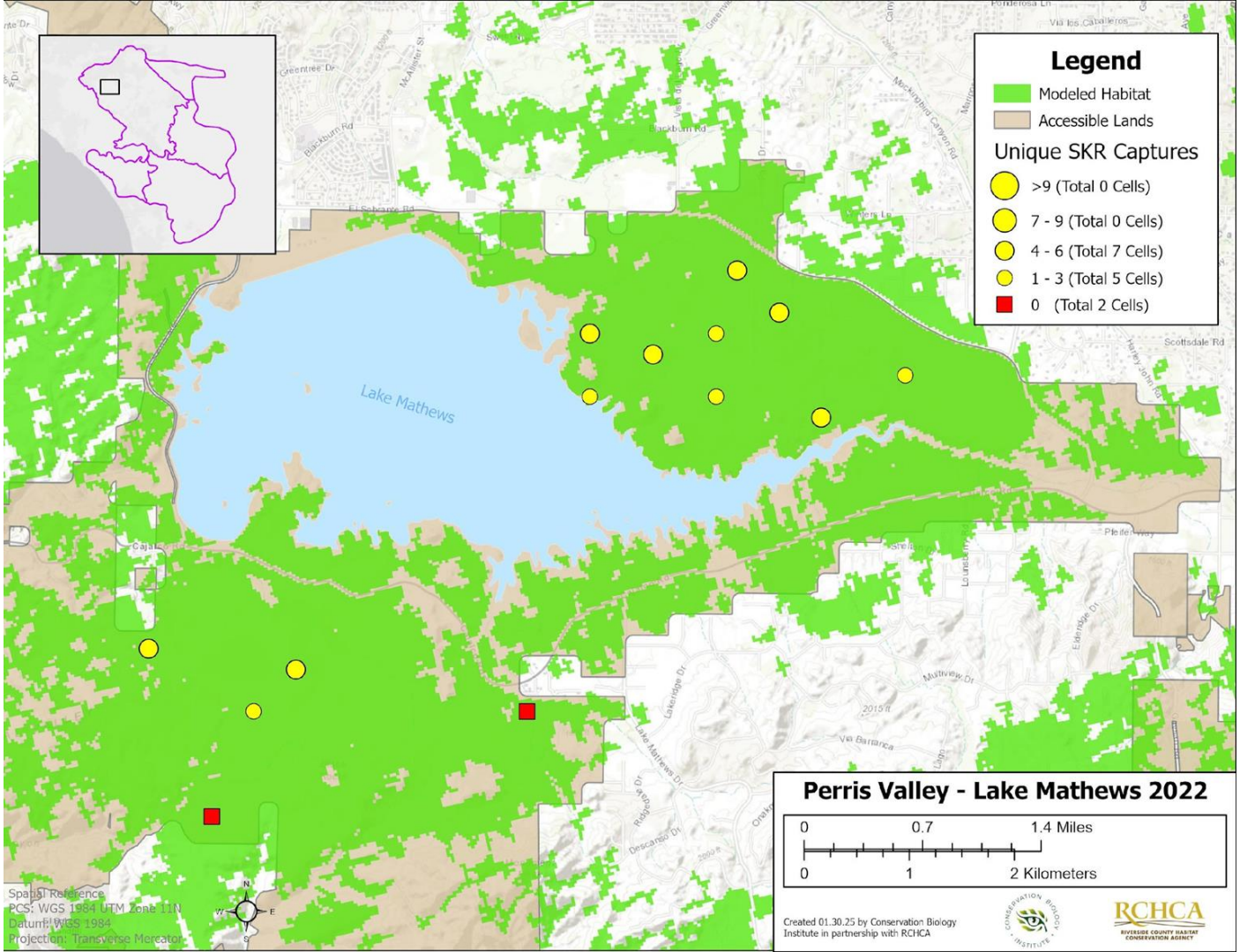


2022 – 2024 Monitoring Results

Statistic	Monitoring Year		
	2022	2023	2024
Total Sample Cells Surveyed	81	79	73
Revisits	-	48	44
New Sample Cells	-	31	29
Sample Cells with K-rat Sign and Trapped	55	34	42
Sample Cells with Confirmed SKR	42	27	32
Total Unique SKR Captured	160	81	187
% Occupancy	51.8%	34.2%	43.8%
Max Captures per Cell	10	9	18
Average Unique Captures per Occupied Cell	3.8	3.0	5.8


SKR Captures
Year over year changes
from resampled cells
Unique Individuals
20
15
10
5
0
2022
2023
2024
Year


Legend
Modeled Habitat
Monitoring Regions
Unique SKR Captures
>9 (Total 1 Cells)
7 - 9 (Total 2 Cells)
4 - 6 (Total 18 Cells)
1 - 3 (Total 21 Cells)
0 (Total 39 Cells)
Badlands - Banning
Perris Valley
Anza - Aguanga
Coastal San Diego
No Data
Inland San Diego
CA
SKR Rangewide Survey Results 2022
0 10 20 Miles
0 20 40 Kilometers
Spatial Reference
PCS: WGS 1984 UTM Zone 11N
Datum: WGS 1984
Projection: Transverse Mercator
Created 01.30.25 by Conservation Biology Institute in partnership with RCHCA
RCHCA
RIVERSIDE COUNTY HABITAT CONSERVATION AGENCY


Legend
Modeled Habitat
Accessible Lands
Unique SKR Captures
>9 (Total 0 Cells)
7 - 9 (Total 0 Cells)
4 - 6 (Total 7 Cells)
1 - 3 (Total 5 Cells)
0 (Total 2 Cells)
Lake Mathews
Perris Valley - Lake Mathews 2022
0 0.7 1.4 Miles
0 1 2 Kilometers
Spatial Reference
PCS: WGS 1984 UTM Zone 11N
Datum: WGS 1984
Projection: Transverse Mercator
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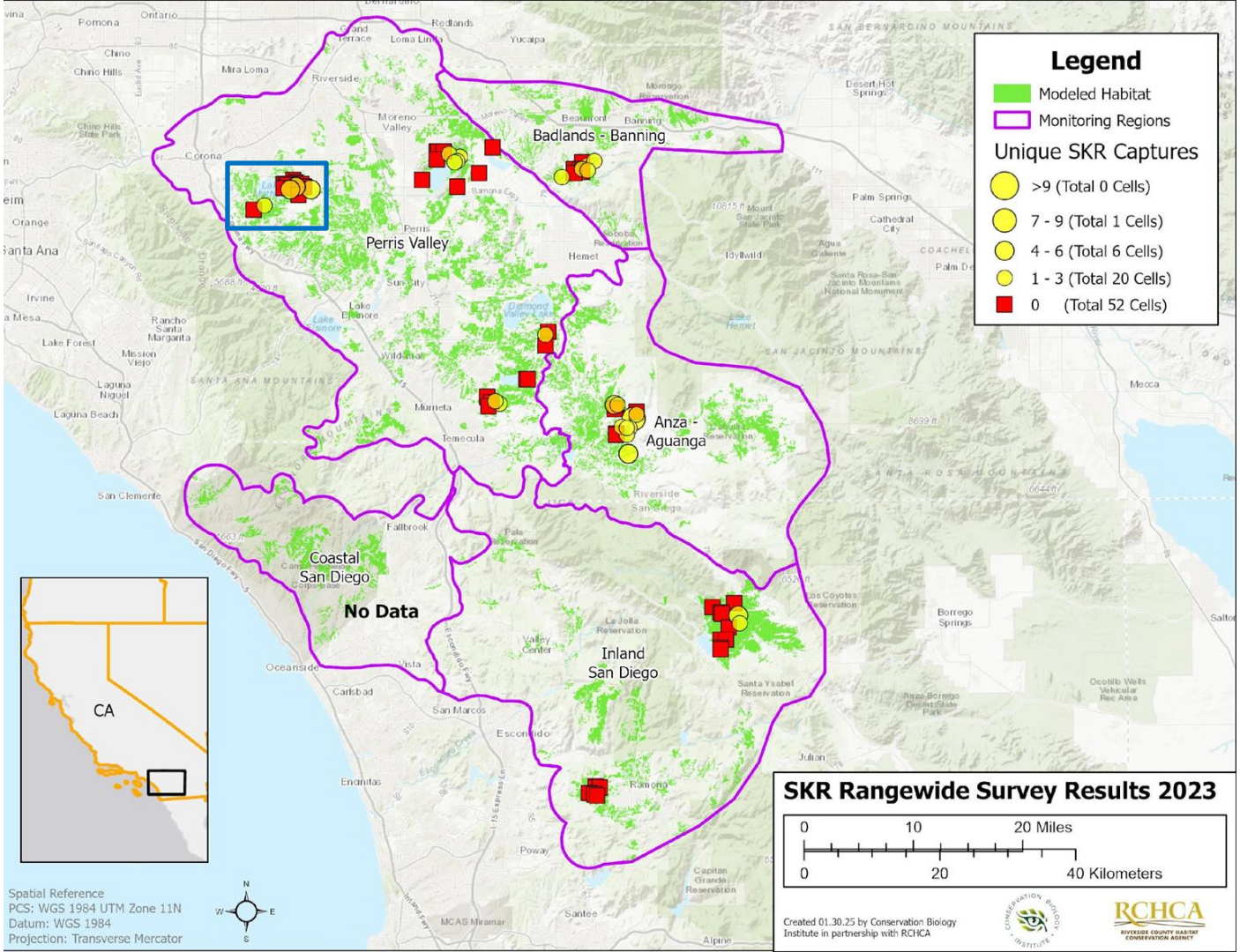
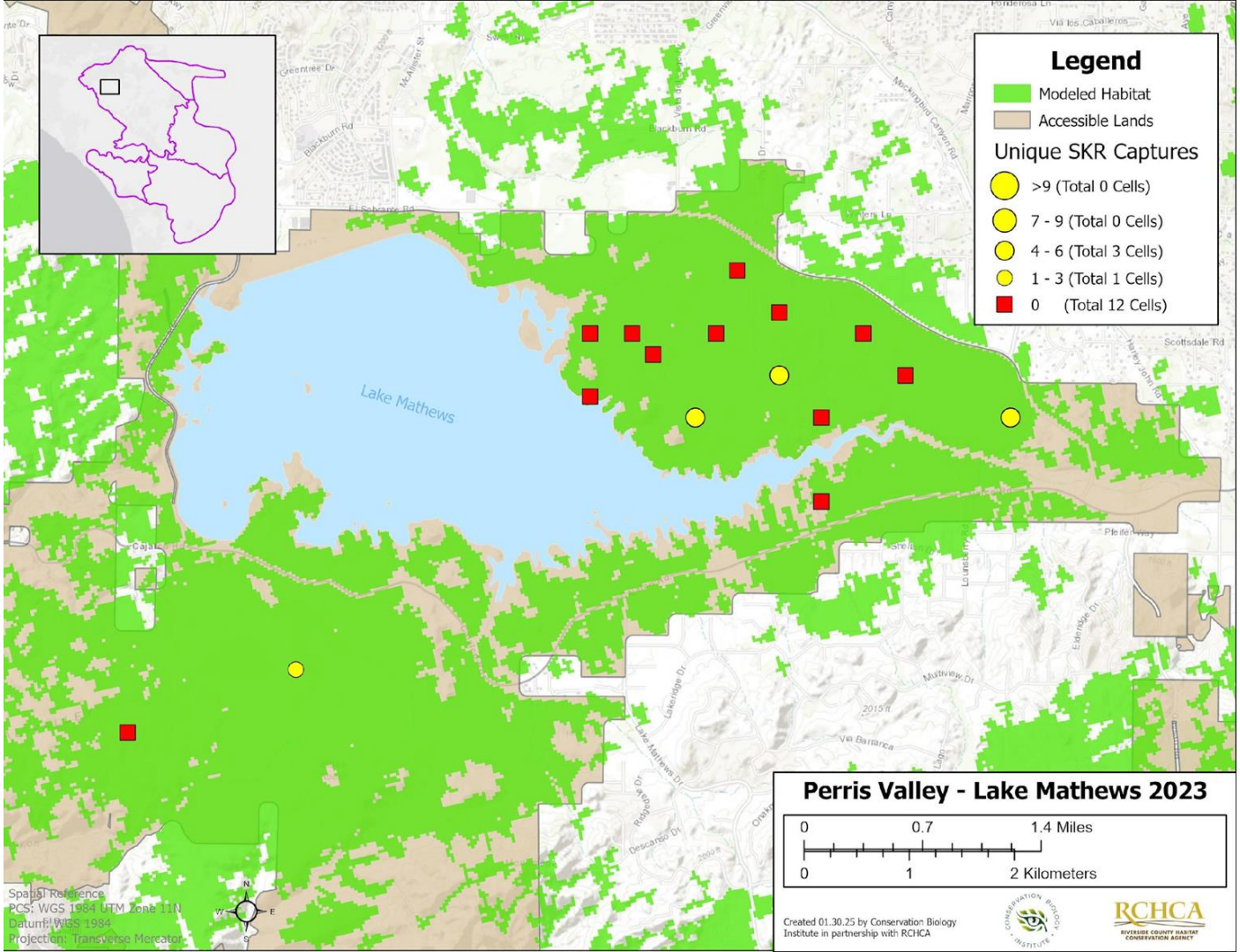
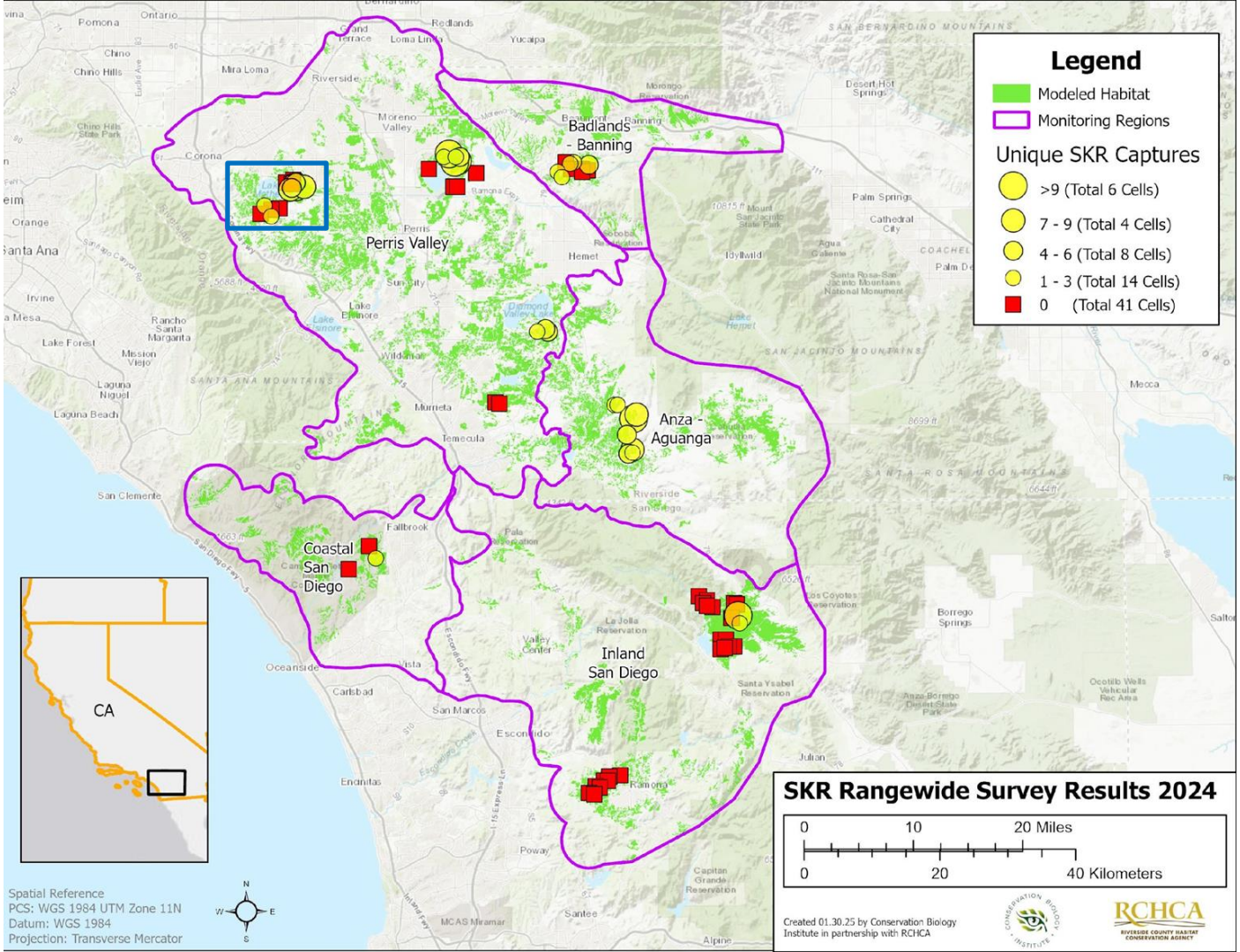

Legend
Modeled Habitat
Monitoring Regions
Unique SKR Captures
>9 (Total 0 Cells)
7 - 9 (Total 1 Cells)
4 - 6 (Total 6 Cells)
1 - 3 (Total 20 Cells)
0 (Total 52 Cells)
Badlands - Banning
Perris Valley
Anza - Aguanga
Coastal San Diego
No Data
Inland San Diego
CA
SKR Rangewide Survey Results 2023
0 10 20 Miles
0 20 40 Kilometers
Spatial Reference
PCS: WGS 1984 UTM Zone 11N
Datum: WGS 1984
Projection: Transverse Mercator
Created 01.30.25 by Conservation Biology Institute in partnership with RCHCA
RCHCA
RIVERSIDE COUNTY HABITAT CONSERVATION AGENCY


Legend
Modeled Habitat
Accessible Lands
Unique SKR Captures
>9 (Total 0 Cells)
7 - 9 (Total 0 Cells)
4 - 6 (Total 3 Cells)
1 - 3 (Total 1 Cells)
0 (Total 12 Cells)
Lake Mathews
Perris Valley - Lake Mathews 2023
0 0.7 1.4 Miles
0 1 2 Kilometers
Spatial Reference
PCS: WGS 1984 UTM Zone 11N
Datum: WGS 1984
Projection: Transverse Mercator
Created 01.30.25 by Conservation Biology Institute in partnership with RCHCA
RCHCA
RIVERSIDE COUNTY HABITAT CONSERVATION AGENCY


Legend
Modeled Habitat
Monitoring Regions
Unique SKR Captures
>9 (Total 6 Cells)
7 - 9 (Total 4 Cells)
4 - 6 (Total 8 Cells)
1 - 3 (Total 14 Cells)
0 (Total 41 Cells)
Badlands - Banning
Perris Valley
Anza - Aguanga
Coastal San Diego
Inland San Diego
CA
SKR Rangewide Survey Results 2024
0 10 20 Miles
0 20 40 Kilometers
Spatial Reference
PCS: WGS 1984 UTM Zone 11N
Datum: WGS 1984
Projection: Transverse Mercator
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Created 01.30.25 by Conservation Biology Institute in partnership with RCHCA
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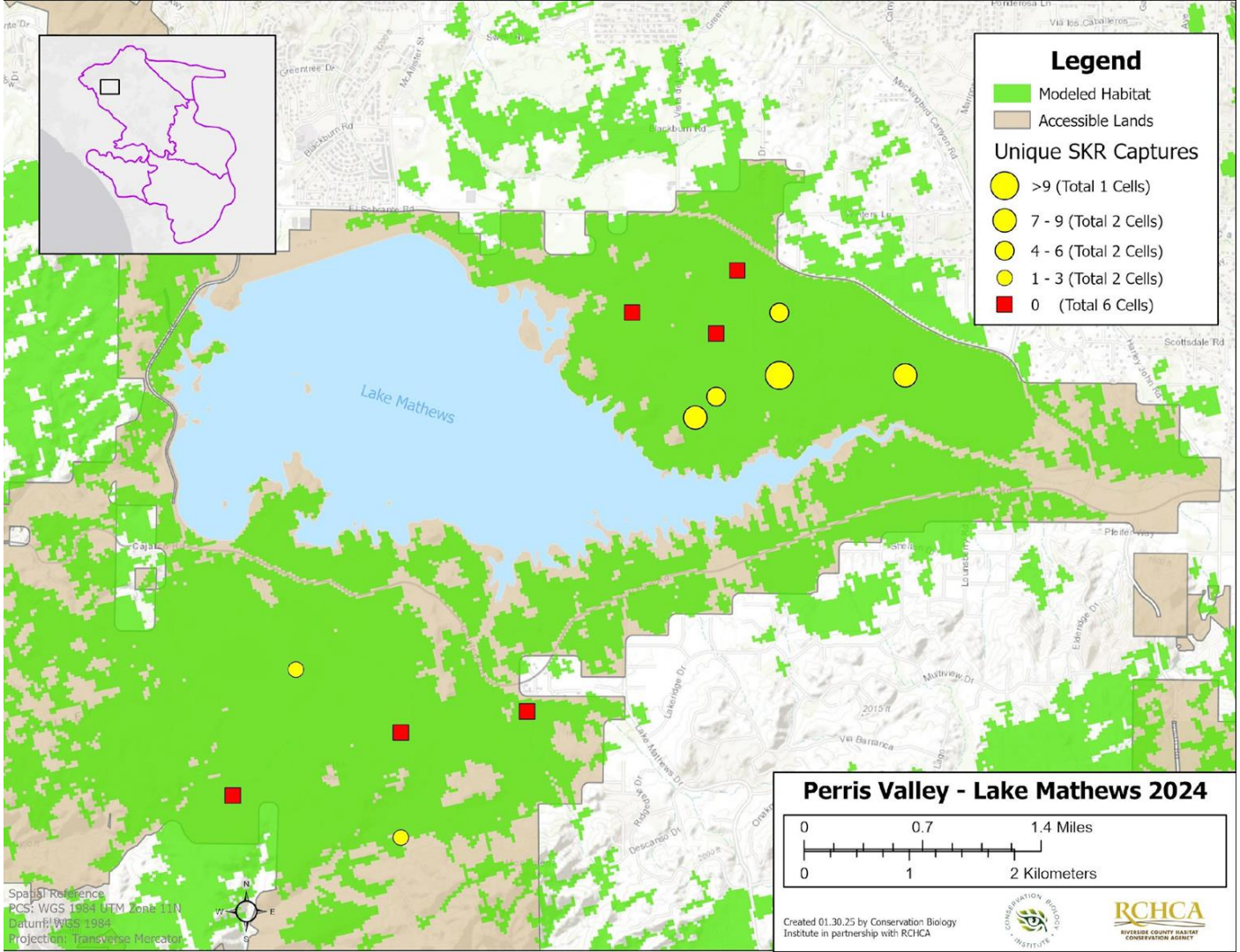
RIVERSIDE COUNTY HABITAT CONSERVATION AGENCY


Legend
Modeled Habitat
Accessible Lands
Unique SKR Captures
>9 (Total 1 Cells)
7 - 9 (Total 2 Cells)
4 - 6 (Total 2 Cells)
1 - 3 (Total 2 Cells)
0 (Total 6 Cells)
Lake Mathews
Perris Valley - Lake Mathews 2024
0 0.7 1.4 Miles
0 1 2 Kilometers
Spatial Reference
PCS: WGS 1984 UTM Zone 11N
Datum: WGS 1984
Projection: Transverse Mercator
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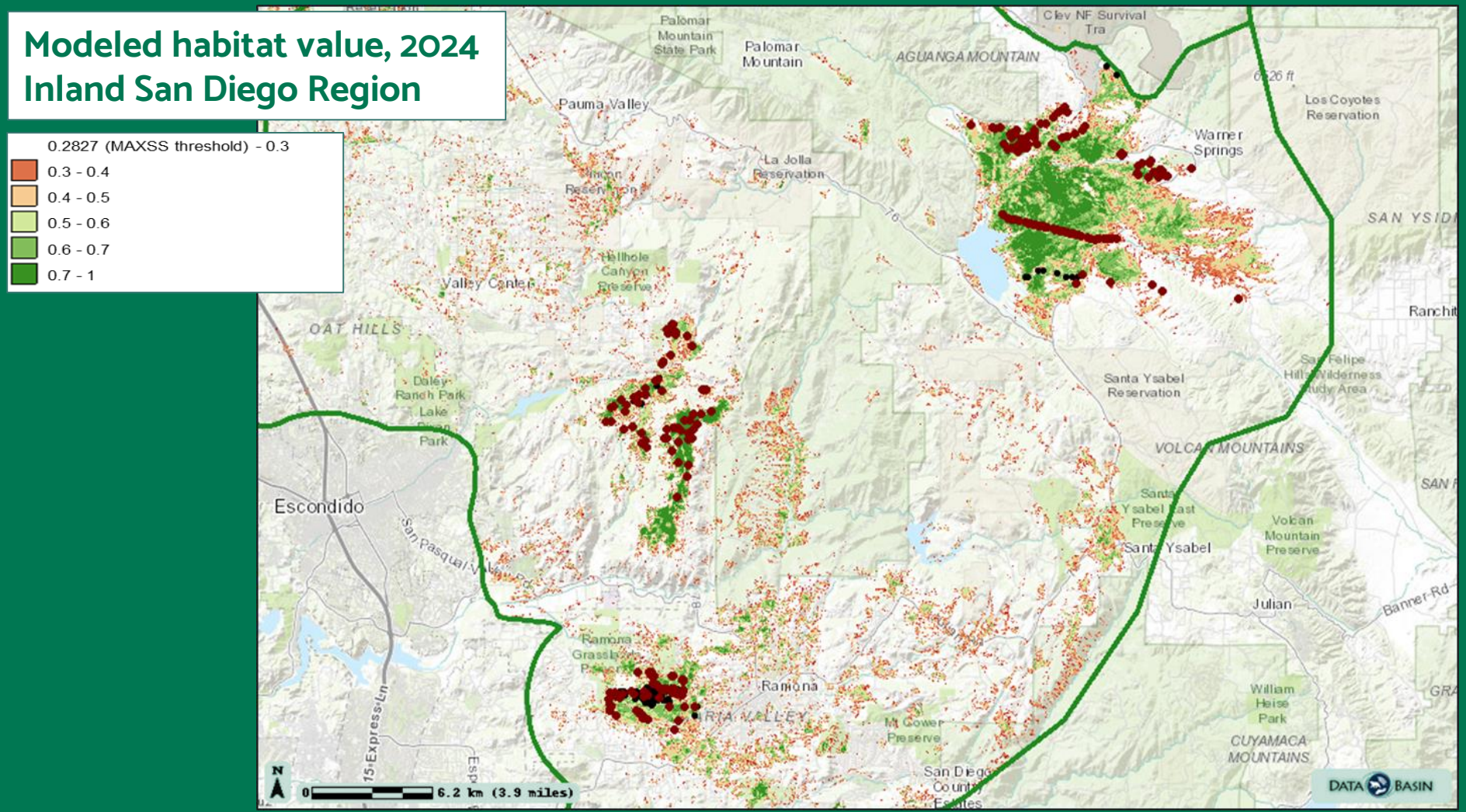
RIVERSIDE COUNTY HABITAT CONSERVATION AGENCY

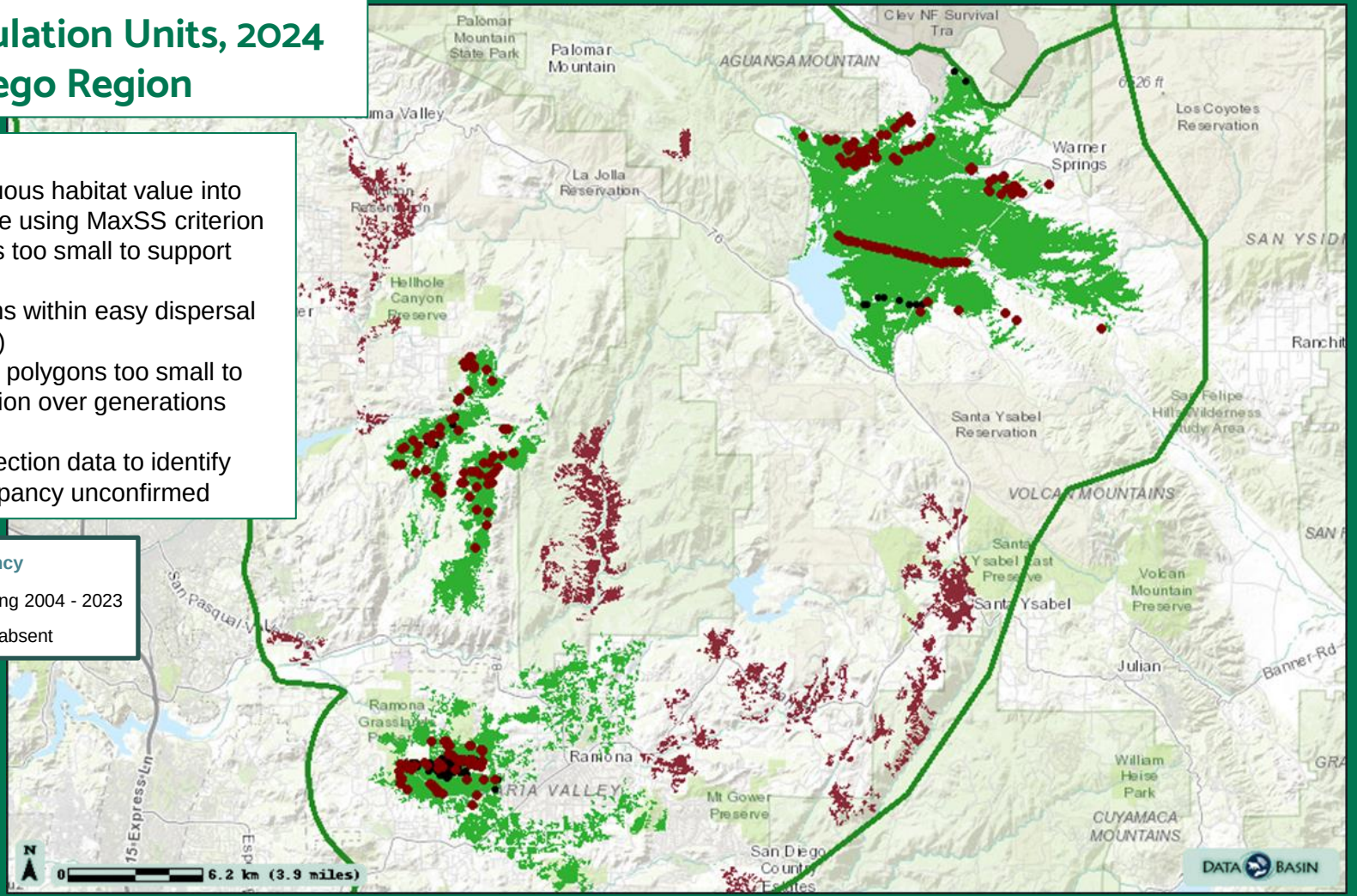
Modeled habitat value, 2024
Inland San Diego Region

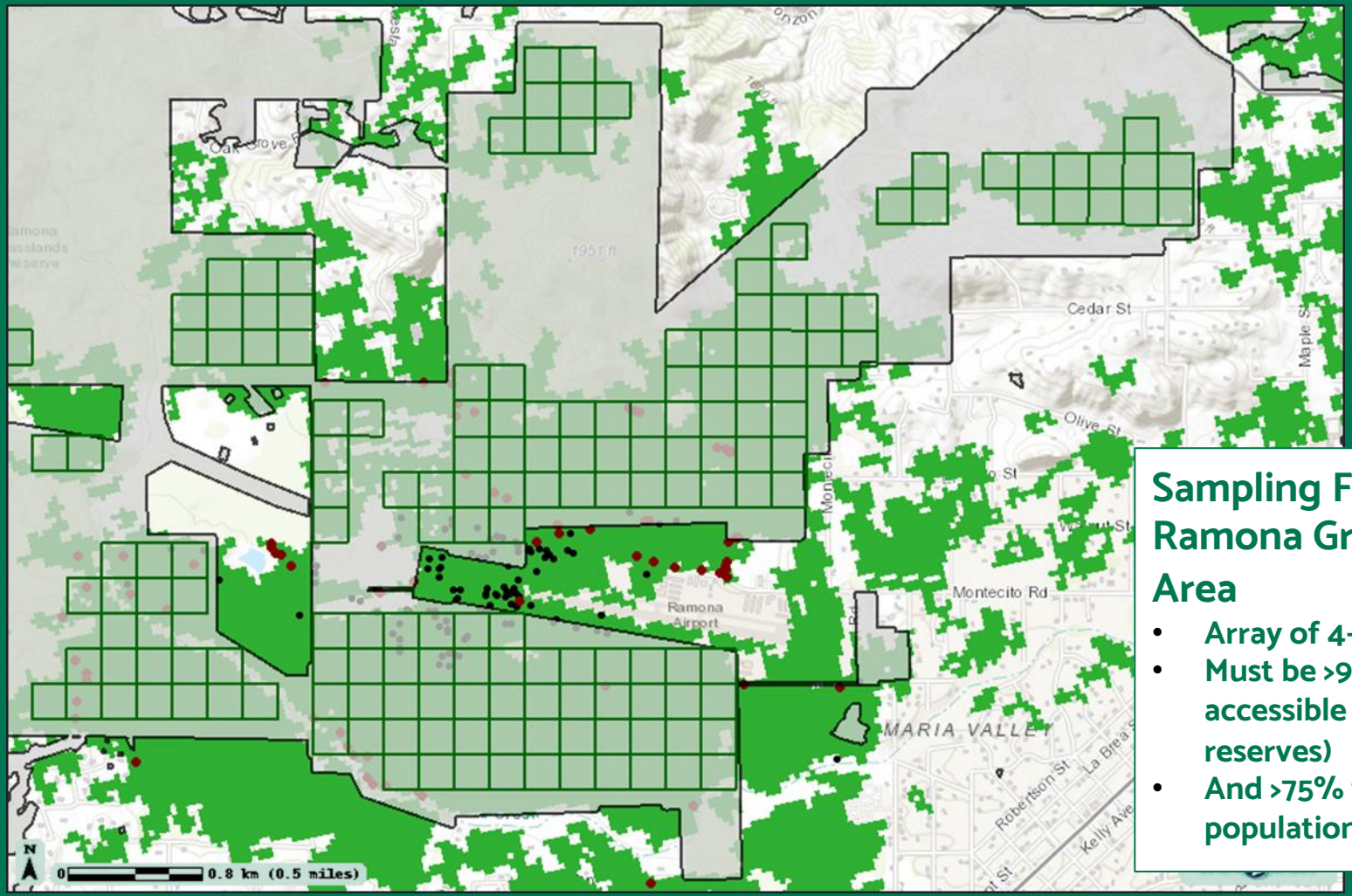


Modeled Population Units, 2024
Inland San Diego Region

Methods

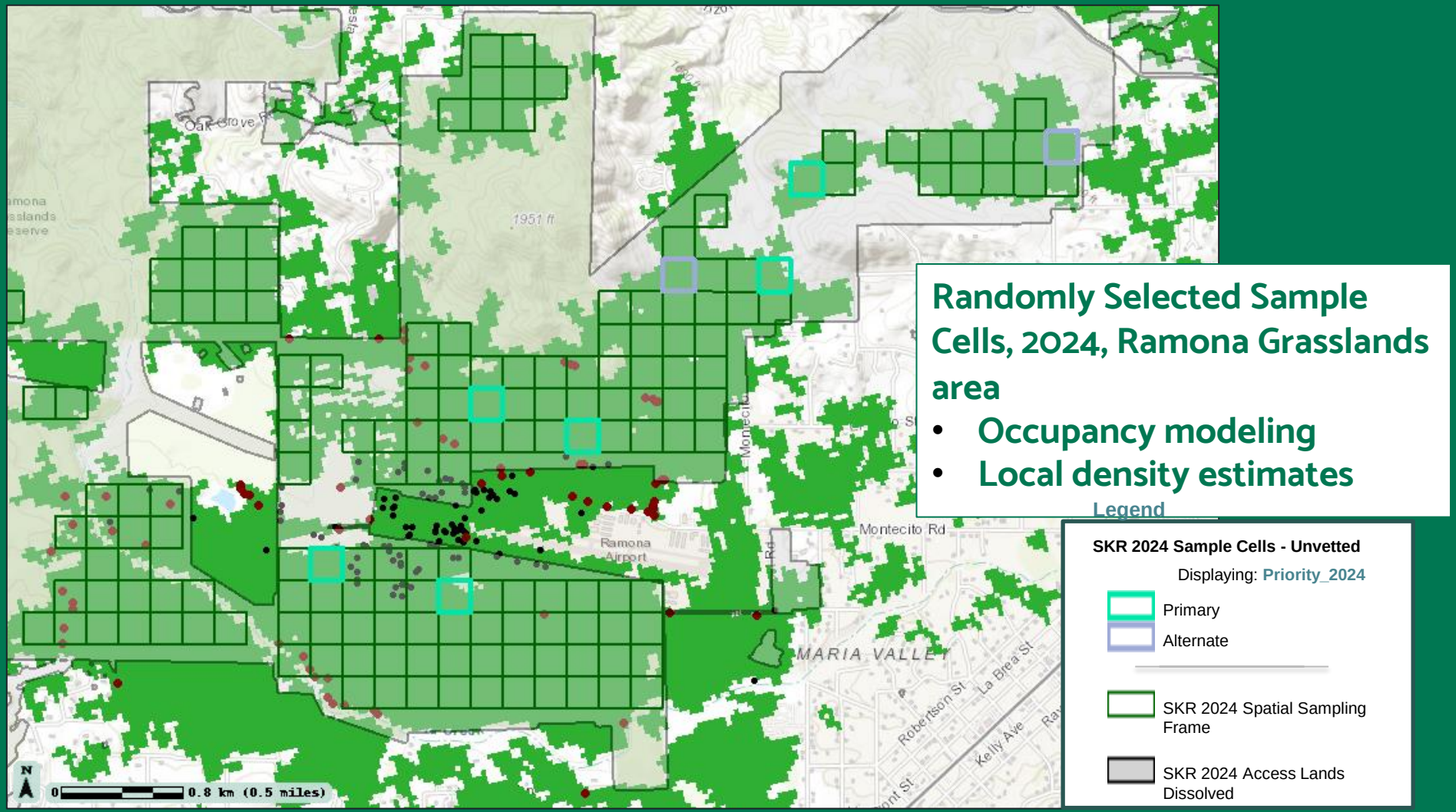
- Threshold continuous habitat value into suitable/unsuitable using MaxSS criterion
- Remove polygons too small to support SKR (<1 ha)
- Coalesce polygons within easy dispersal distance (<200 m)
- Remove resulting polygons too small to support a population over generations (<50 ha)
- Intersect with detection data to identify occupied vs occupancy unconfirmed





Sampling Frame, 2024 Ramona Grasslands Area

- Array of 4-ha sample cells
- Must be >95% within accessible lands (e.g., reserves)
- And >75% within population units



Randomly Selected Sample Cells, 2024, Ramona Grasslands area

- Occupancy modeling
- Local density estimates

Legend

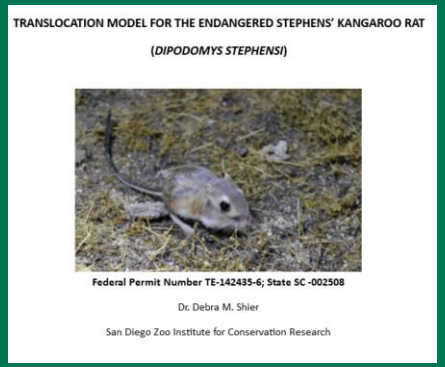
SKR 2024 Sample Cells - Unvetted

Displaying: Priority_2024

- Primary
- Alternate
- SKR 2024 Spatial Sampling Frame
- SKR 2024 Access Lands Dissolved

SKR Translocation Planning

- First priority location: Ramona Grasslands
    - Stallcup Reserve
    - Cumming Ranch?
- Donor sites based on population genetics (Shier et al. In Review)
- Methods: Based on Shier Translocation Model

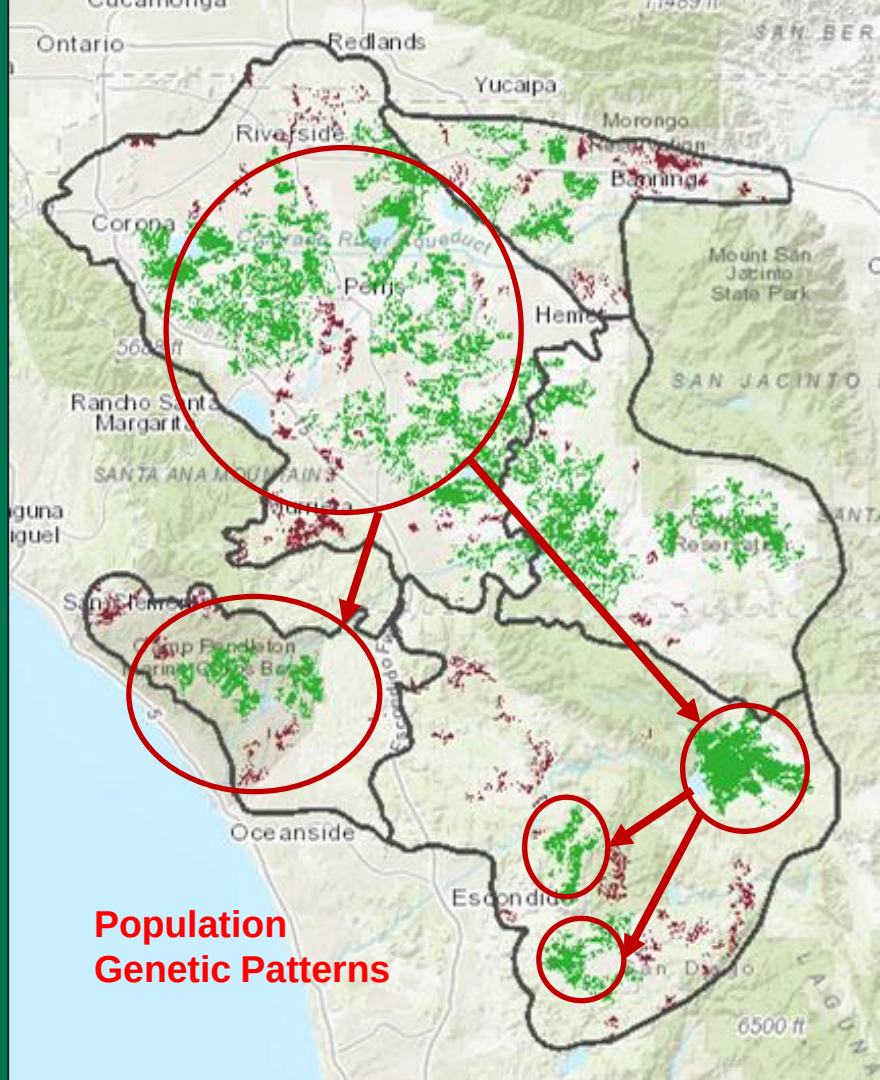

TRANSLOCATION MODEL FOR THE ENDANGERED STEPHENS' KANGAROO RAT

(*DIPODOMYS STEPHENSI*)

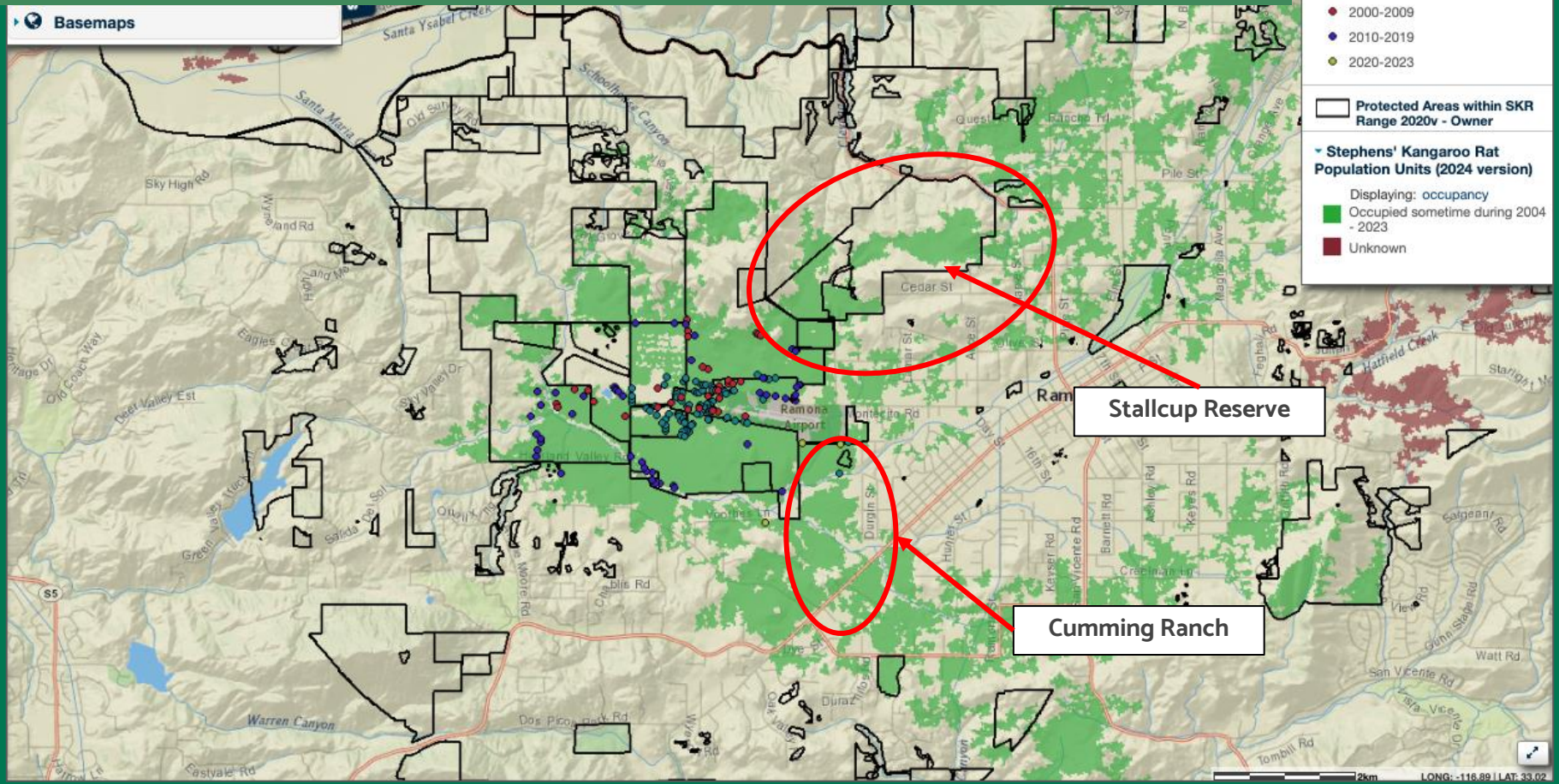
Federal Permit Number TE-142435-6; State SC -002508

Dr. Debra M. Shier

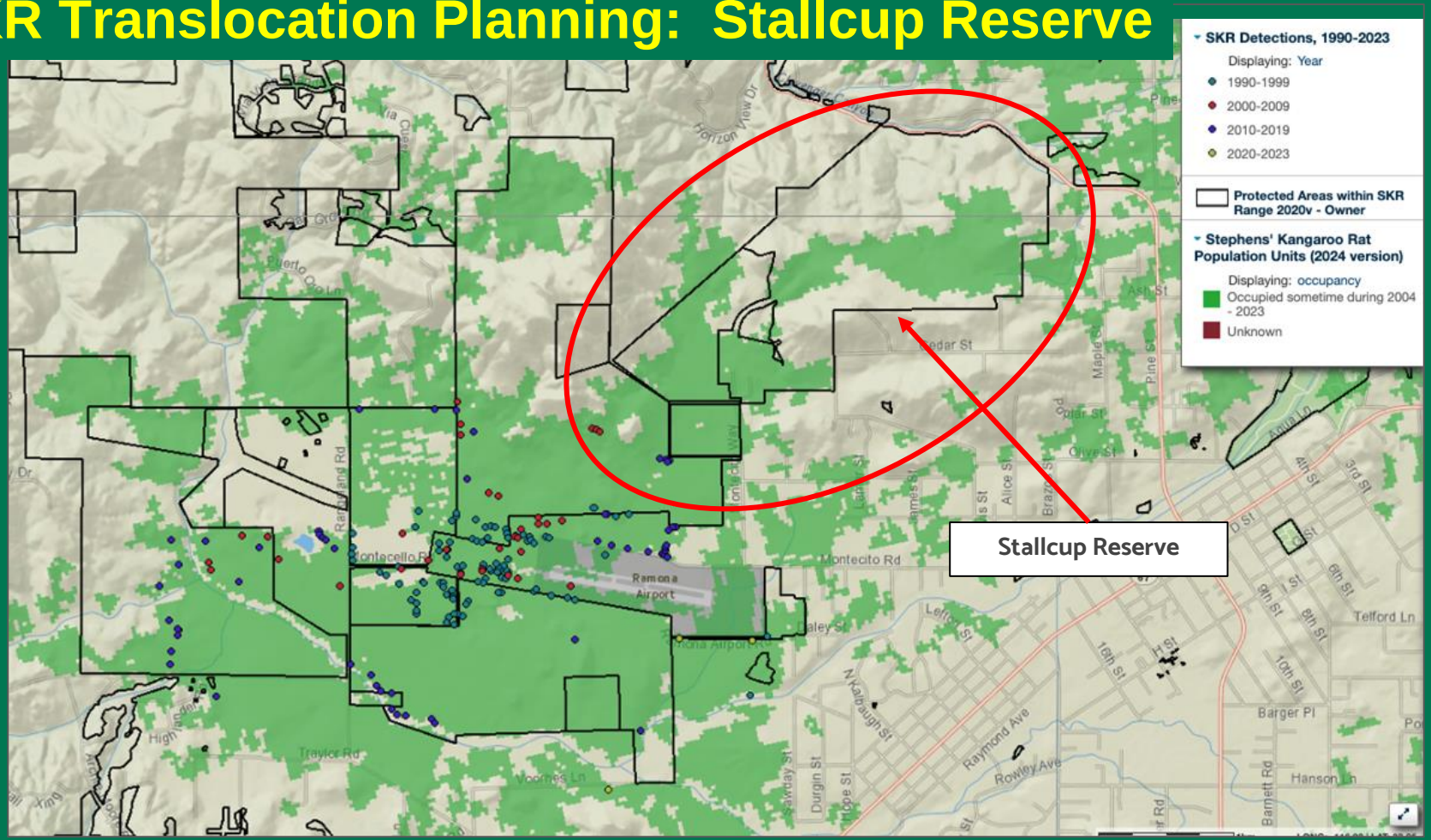
San Diego Zoo Institute for Conservation Research



SKR Translocation Planning: Ramona Grasslands



SKR Translocation Planning: Stallcup Reserve



DISCUSSION

- The rangewide monitoring program is statistically robust and efficient.
- Populations fluctuate with annual weather conditions.
- SKR are most abundant on lands specifically managed to benefit them.
- Increased access in San Diego County would help close gaps in sample frame.
- A genetic-rescue translocation is being considered in the Ramona Grasslands