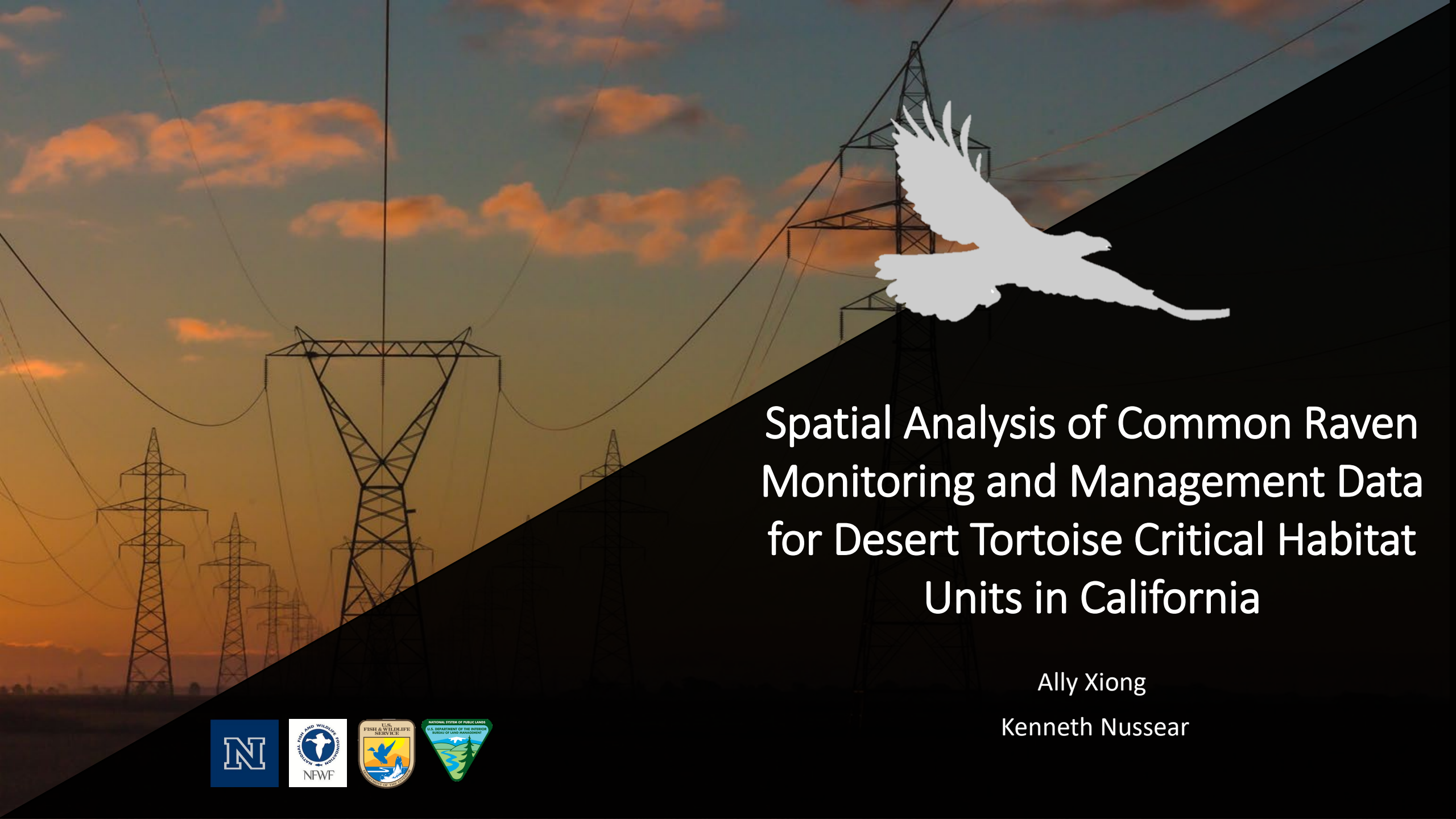


Spatial Analysis of Common Raven Monitoring and Management Data for Desert Tortoise Critical Habitat Units in California

Ally Xiong

Kenneth Nussear

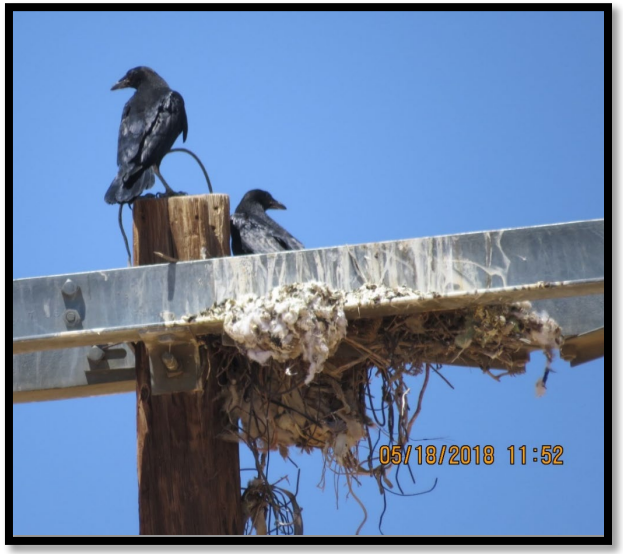
Acknowledgements

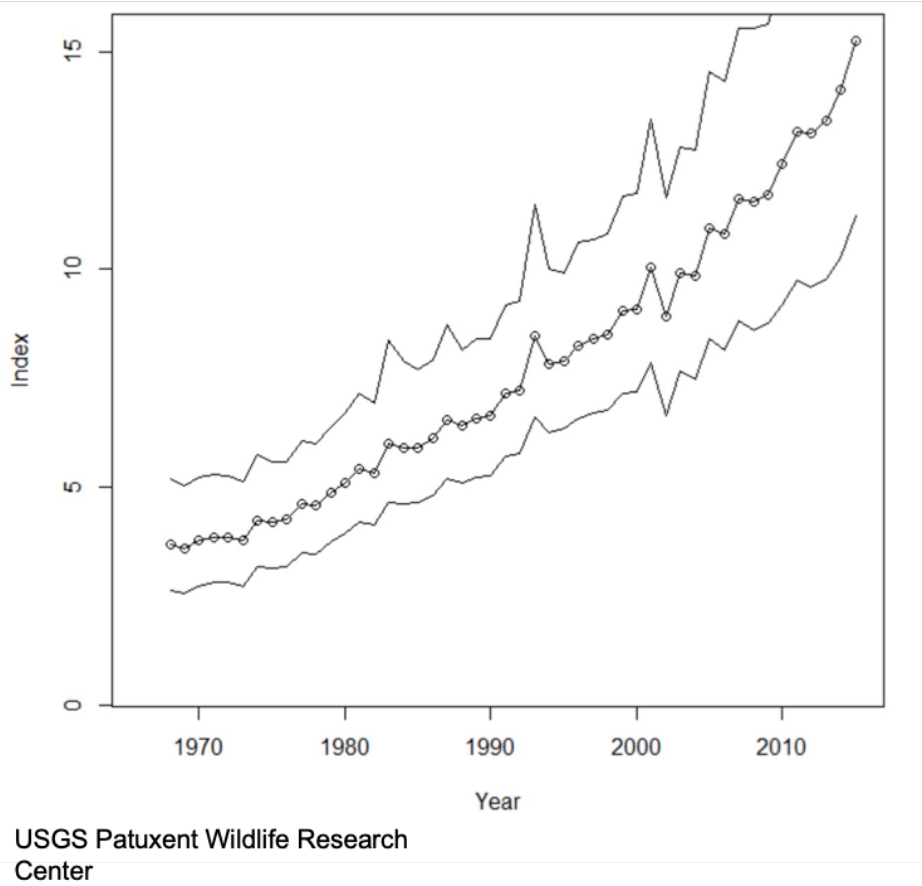
Bajada Ecology, LLC.
Conservation Science Research & Consulting
Corvus Ecological Consulting, LLC.
Hardshell Labs, Inc.
Sundance Biology, Inc.

Purpose

Anthropogenic Subsidies:

- Alteration of the landscape that provides unintended food, water, and nesting resources (Boarman et al., 2006)





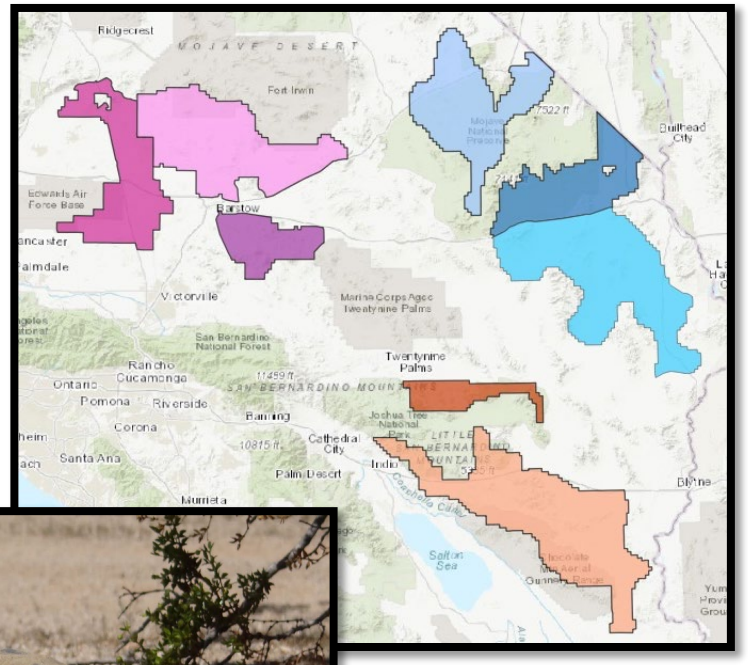
- Disproportionally located near food and water (Kristan et al. 2007)
- Raven occurrence was greater with presence of transmission lines (Coates et al. 2014)
- Ravens select for proximity to transmission lines and land cover edges (Howe et al. 2014)
- Local raven density (Marzluff and Neatherlin 2006) and juvenile survivorship (Webb et al. 2004) increased in areas with increasing human activity and development

Photo Credit: NFWF Dataset

Purpose

Ravens are natural predators of

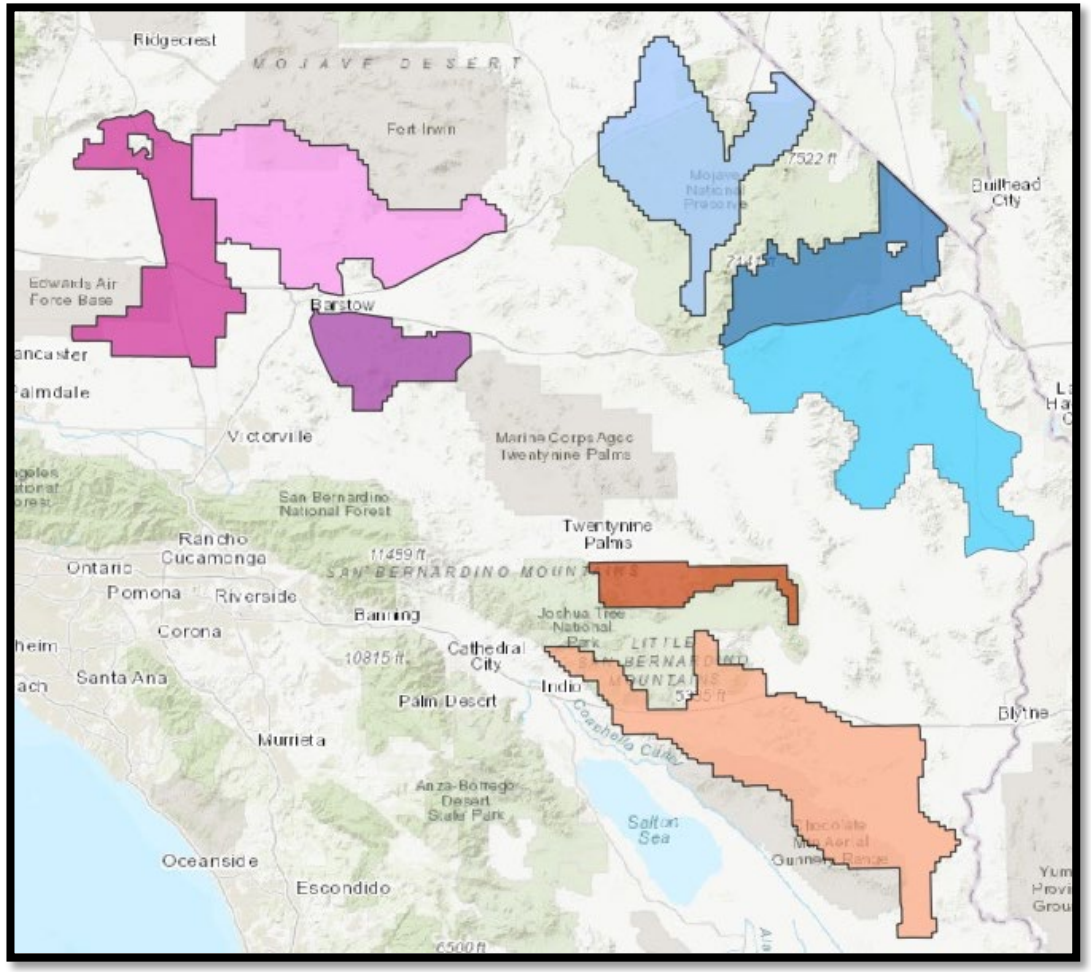
Desert Tortoise



Purpose

- Document and monitor
- Relationship of anthropogenic subsidies and raven population
- Tortoise population

California's Desert Tortoise Critical Habitat Units (CHU)



Survey Methods

CHU and NPS units	2013	2014	2015	2016	2017	2018
Superior-Cronese CHU/Ft. Irwin Conservation Area	Phase 1				Phase 2	
Chemehuevi CHU		Phase 1			Phase 2	
Chuckwalla CHU **	Phase 1				Phase 2	
DTRNA	Phase 1					includes Fremont-Kramer
Mojave NP/Ivanpah CHU/Fenner CHU				Phase 1		
Joshua Tree NP/Pinto Mountains CHU				Phase 1		Phase 2
Ord-Rodman CHU				Phase 1		Phase 2
Fremont-Kramer CHU (includes EAFB and DTRNA)					Phase 1	

Phase 1 : Monitoring actions only

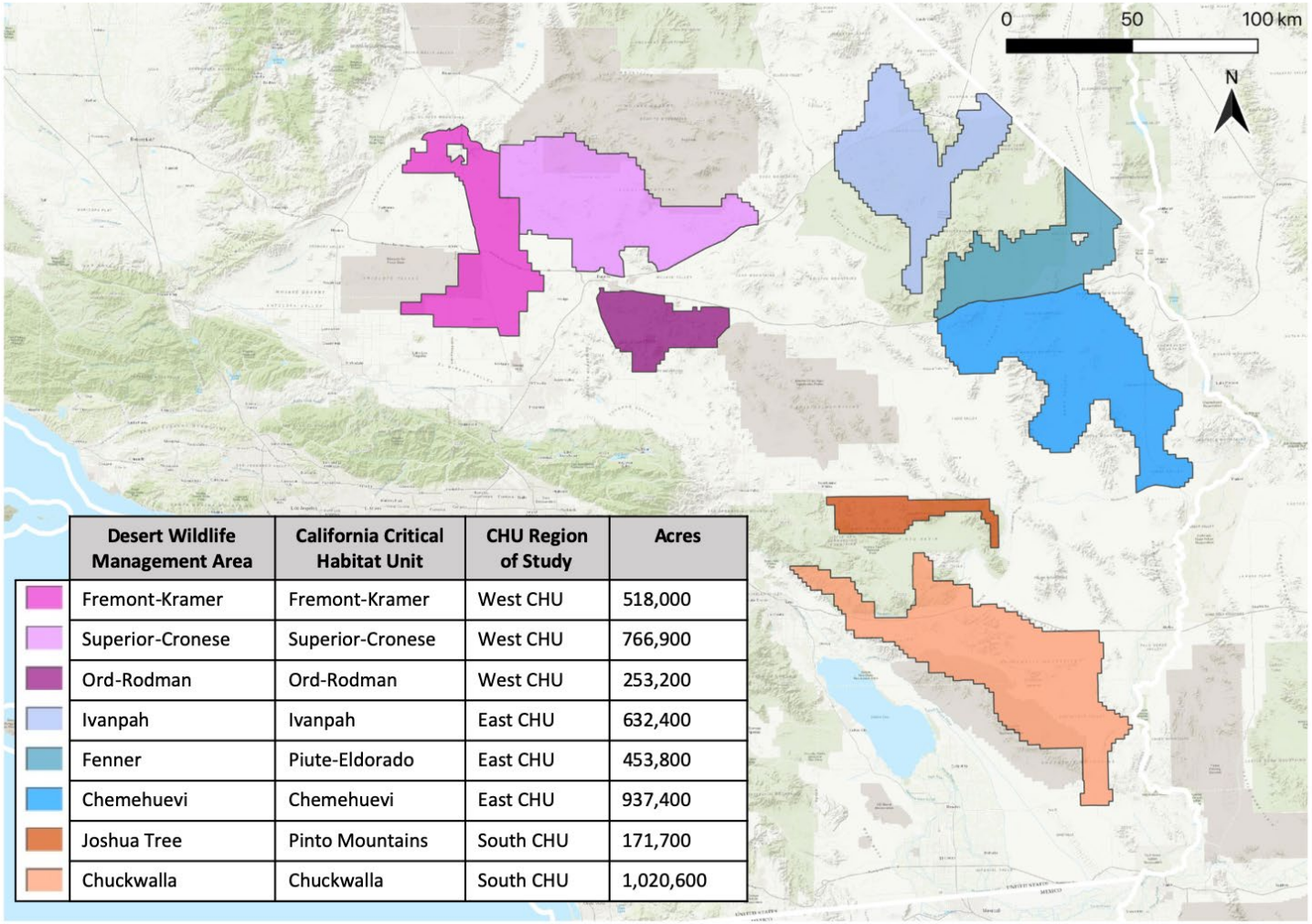
Phase 2 : Management and Monitoring actions

- 10% of the nest had evidence of tortoise predation

Survey Methods

- Surveys done from early March to July
- Established open routes and paved roads
- Transmission lines and anthropogenic structures were of priority

Status of Site	Monitoring Schedule
Potential substrate or no activity	Monitor once per month
Potential substrate or Ravens observed	Monitor once bi-weekly
Nest or roost present, unconfirmed species	Monitor once per week
Confirmed Raven active nest and tortoise remains not found	Monitor once per week
Confirmed Raven active nest and with tortoise remains found	Monitor once per week and coordinate with Wildlife Services
Confirmed inactive Raven nest	Monitor once per week, conducting inspection if birds are present
Confirmed aggregation with tortoise remains found	Coordinate with Wildlife Services to remove offending Raven(s)



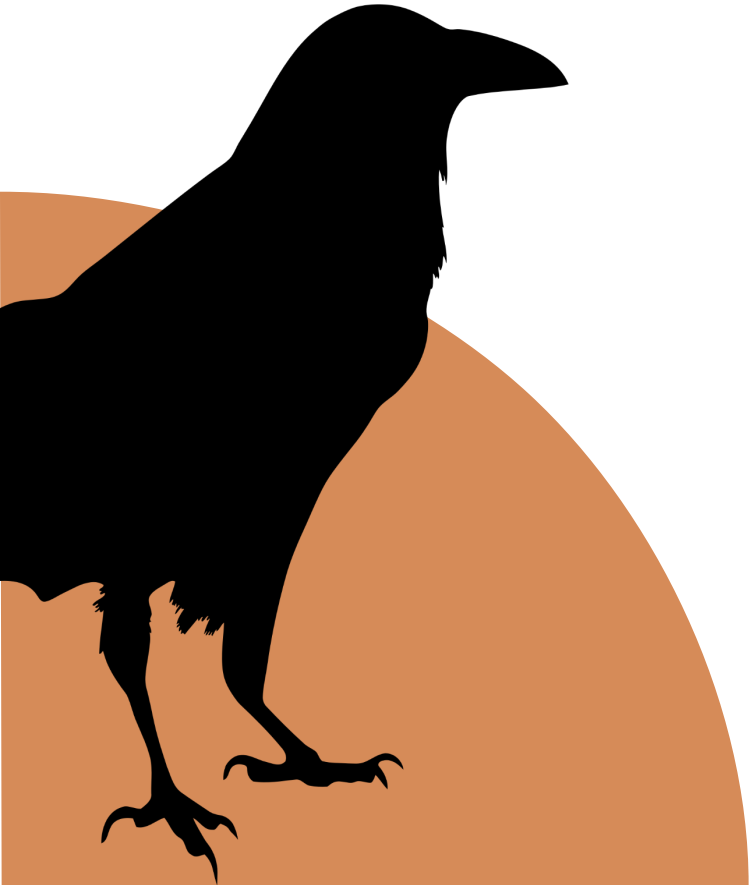
Desert Wildlife Management Area	California Critical Habitat Unit	CHU Region of Study	Acres
Fremont-Kramer	Fremont-Kramer	West CHU	518,000
Superior-Cronese	Superior-Cronese	West CHU	766,900
Ord-Rodman	Ord-Rodman	West CHU	253,200
Ivanpah	Ivanpah	East CHU	632,400
Fenner	Piute-Eldorado	East CHU	453,800
Chemehuevi	Chemehuevi	East CHU	937,400
Joshua Tree	Pinto Mountains	South CHU	171,700
Chuckwalla	Chuckwalla	South CHU	1,020,600

Nest Observations

- Species
- Development Stage
- # eggs, hatchlings, fledglings
- Substrate type
  - Natural: tree, cliff/outcrop
  - Anthropogenic: transmission pole, wood pole, signs
- Final nest outcome

	Nest	Active CORA Nest	Anthropogenic Nest	Natural Nest
Total	5229	1449	894	555

Objectives

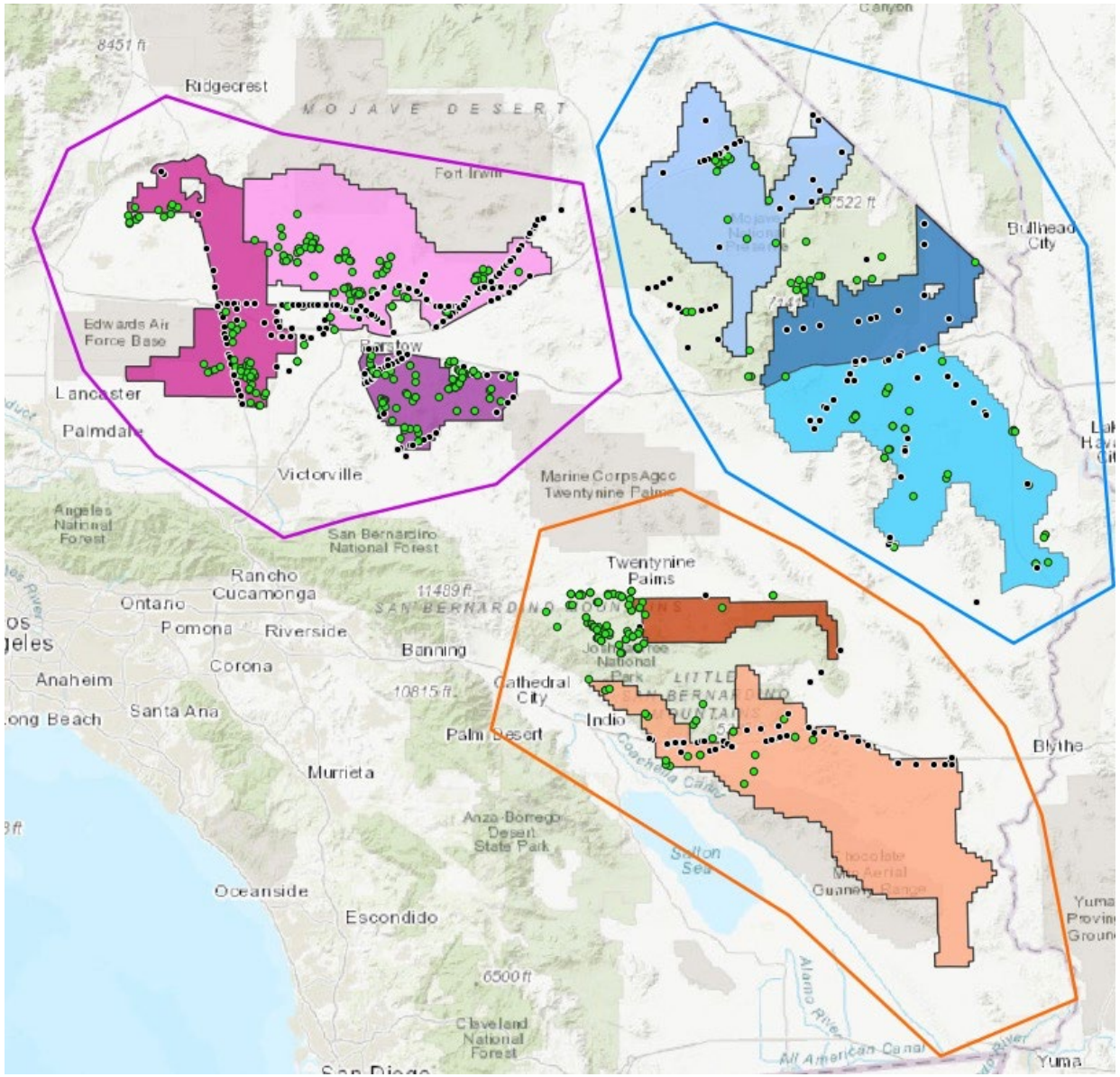


- Nest Density
- Nest Success
- Offending Nests
- Pellet/Diet

Dataset

Methods:

- 3 groups
- 20km buffer
- Only nests considered Active Nest (n=1449), Nest Development Stage:
    - copulation, incubating, nest building, active, fledged, or complete
- 2 substrates: Anthropogenic & Natural

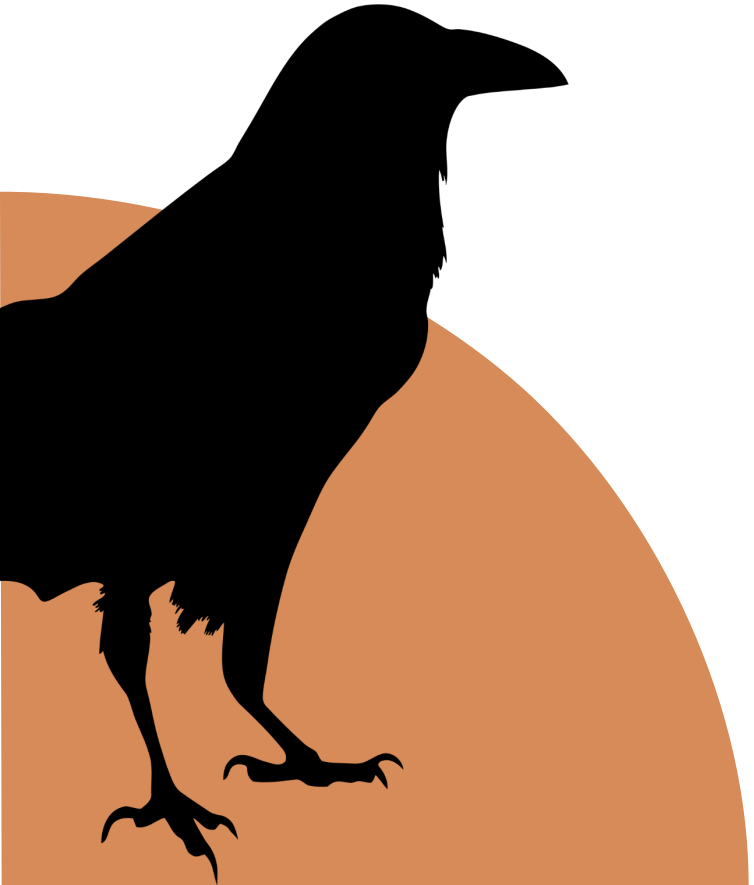


- Natural substrate (n =555)
- Anthropogenic substrate (n= 894)

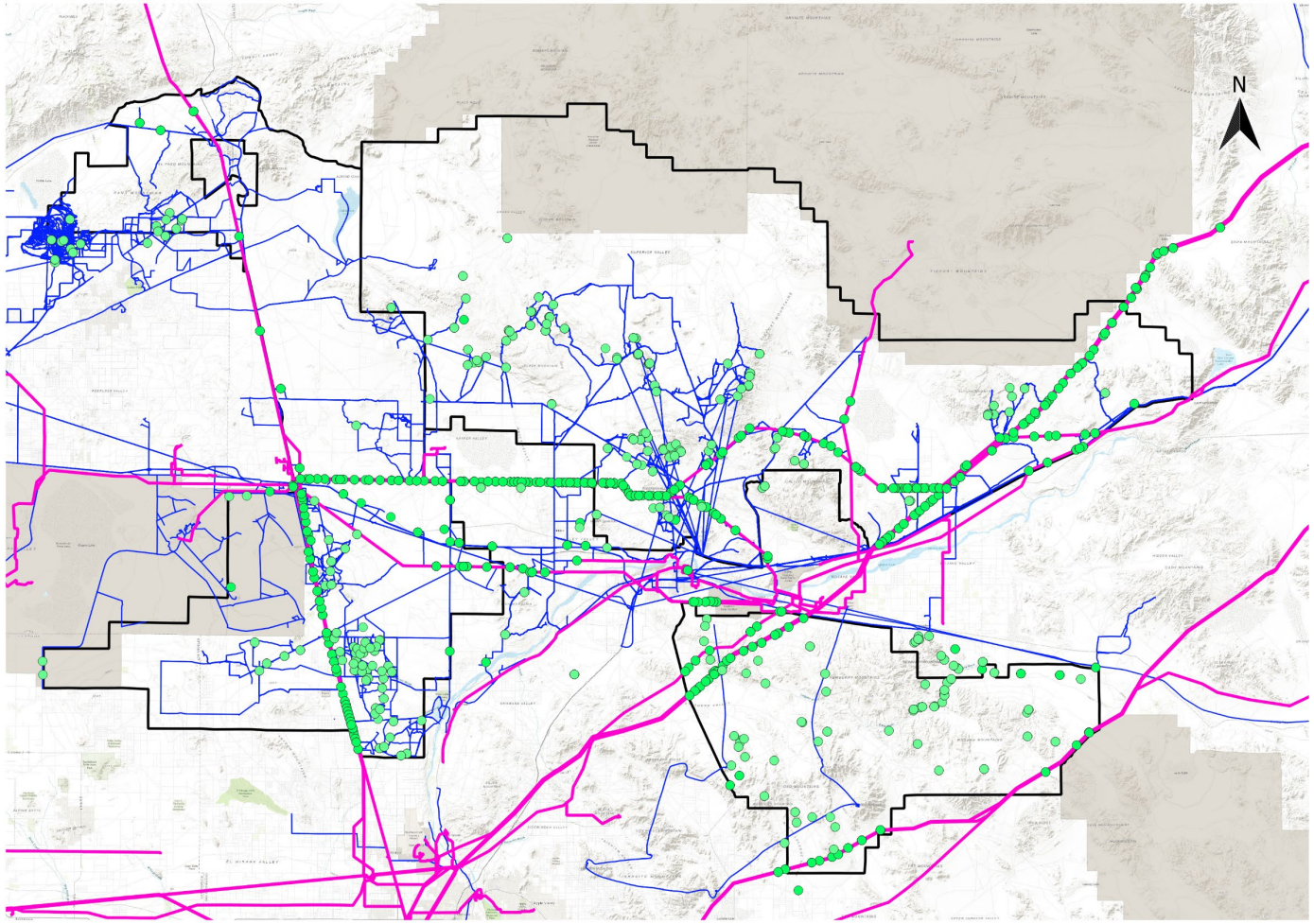
Objectives

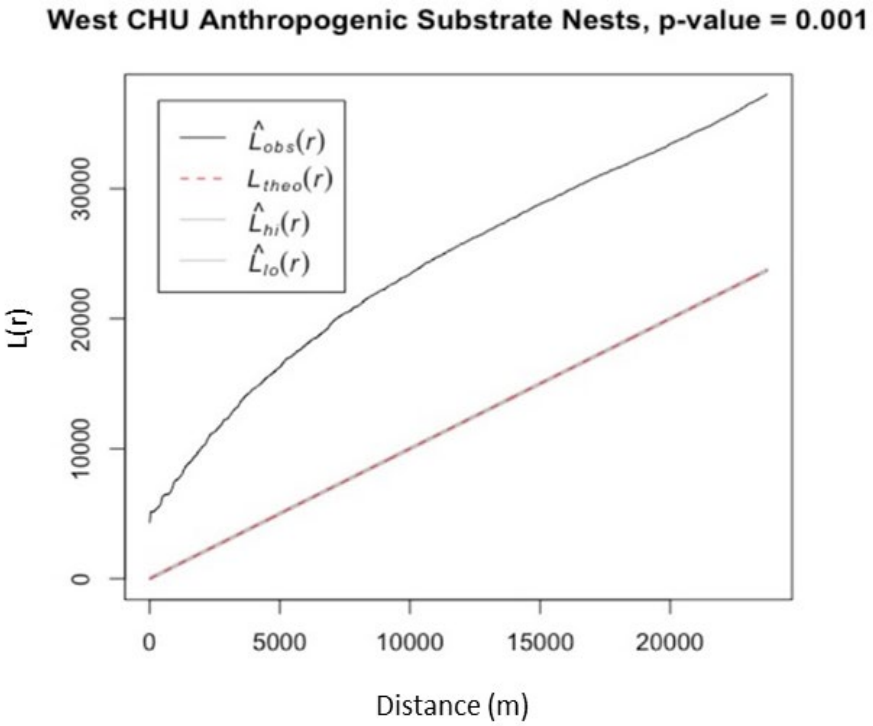
Point Process Model (PPM) →

- Nest Density
- Nest Success
- Offending Nests
- Pellet/Diet



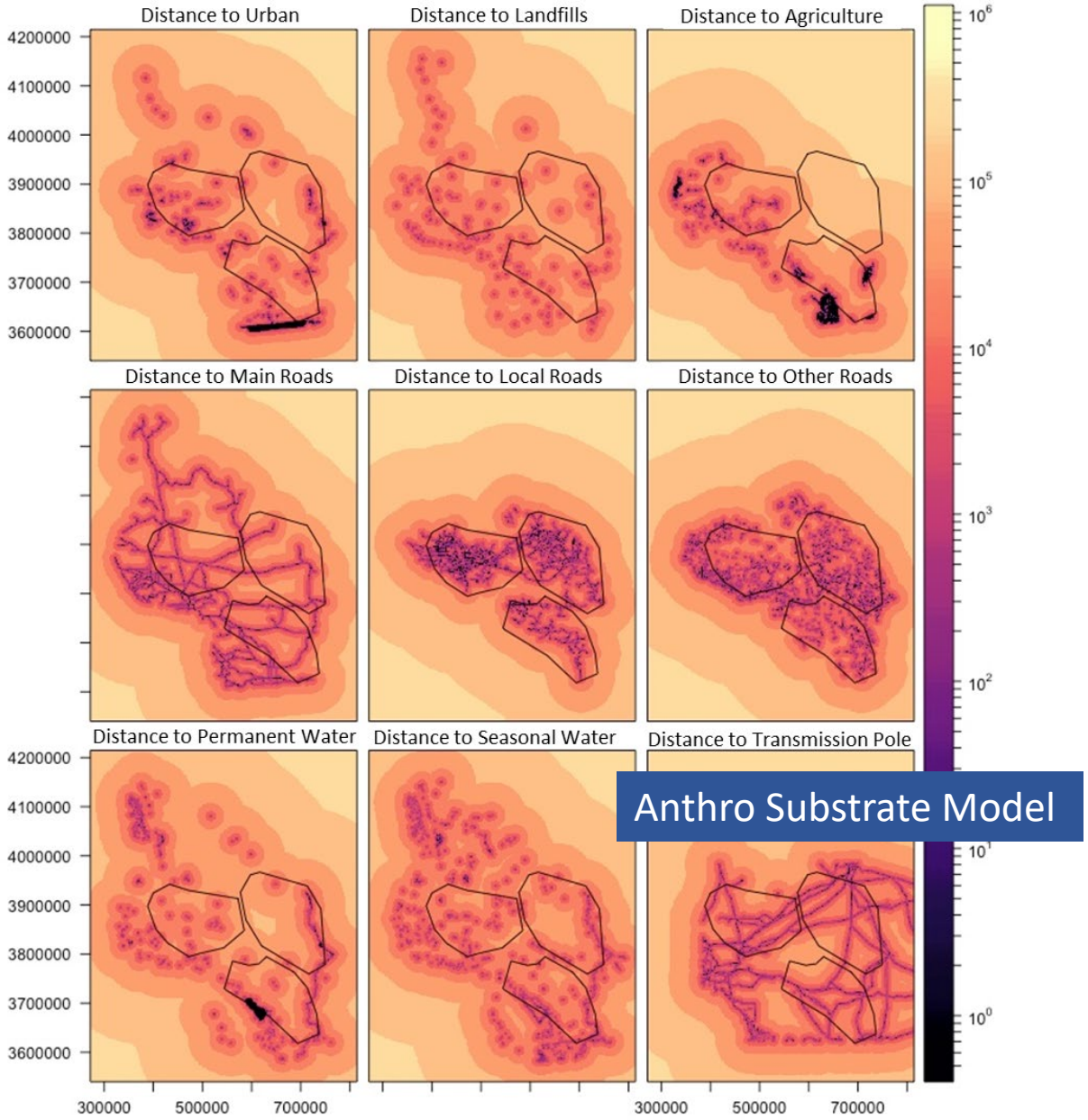
Nest Density Methods



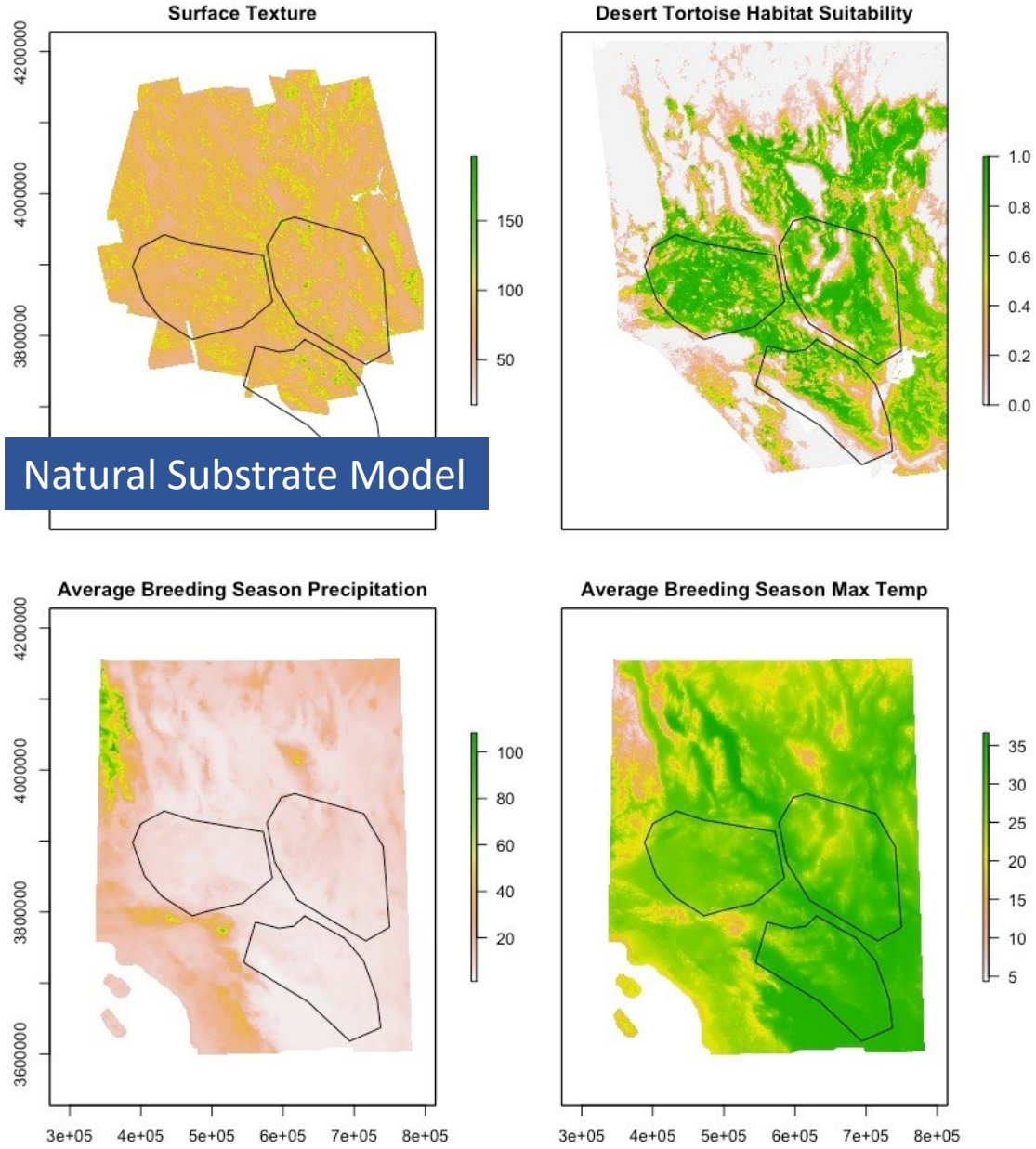


- Clustering/spatial autocorrelation
- Ripely's K-function → L-function
- Cox point process modeling

Nest Density Model Covariates

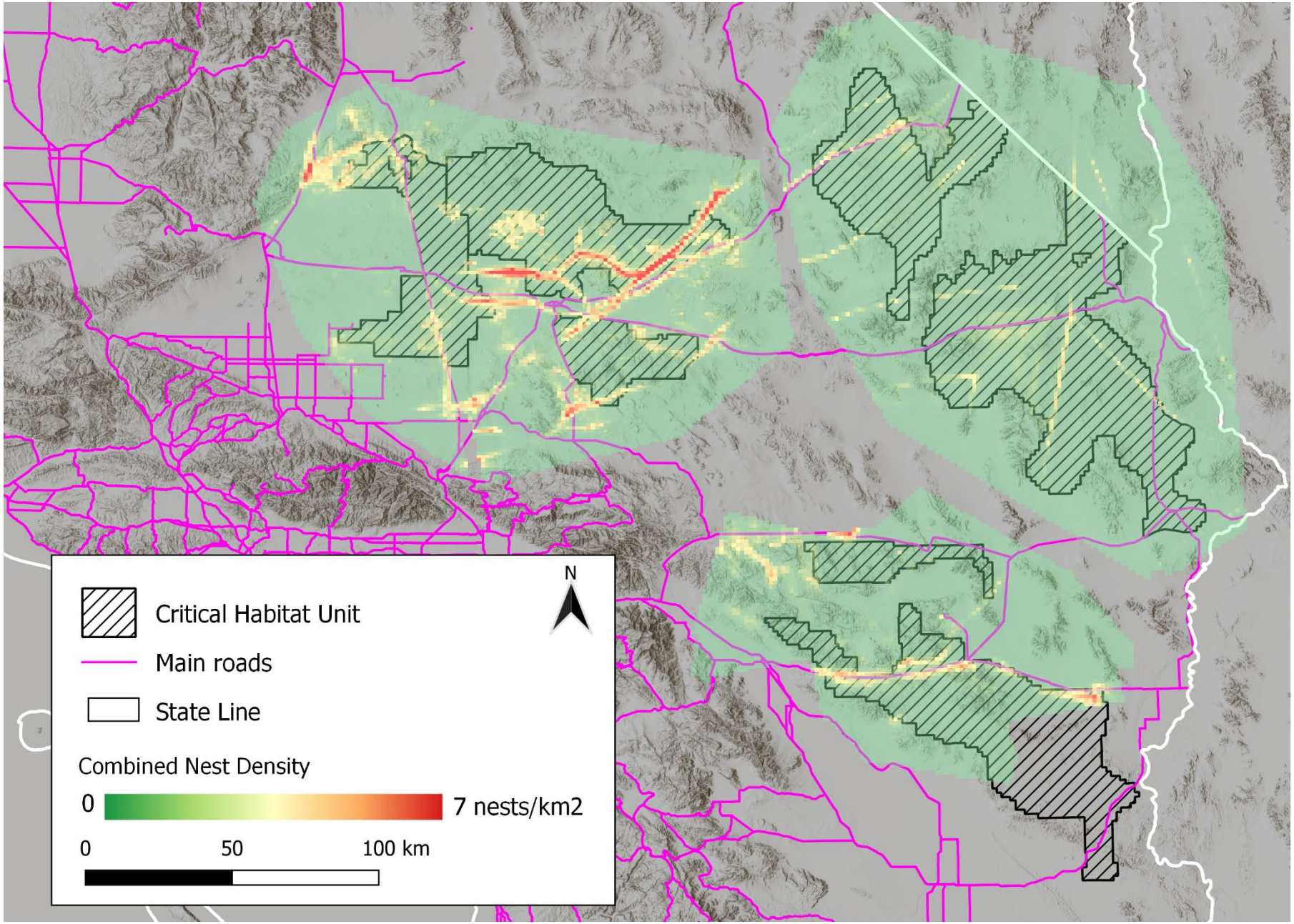


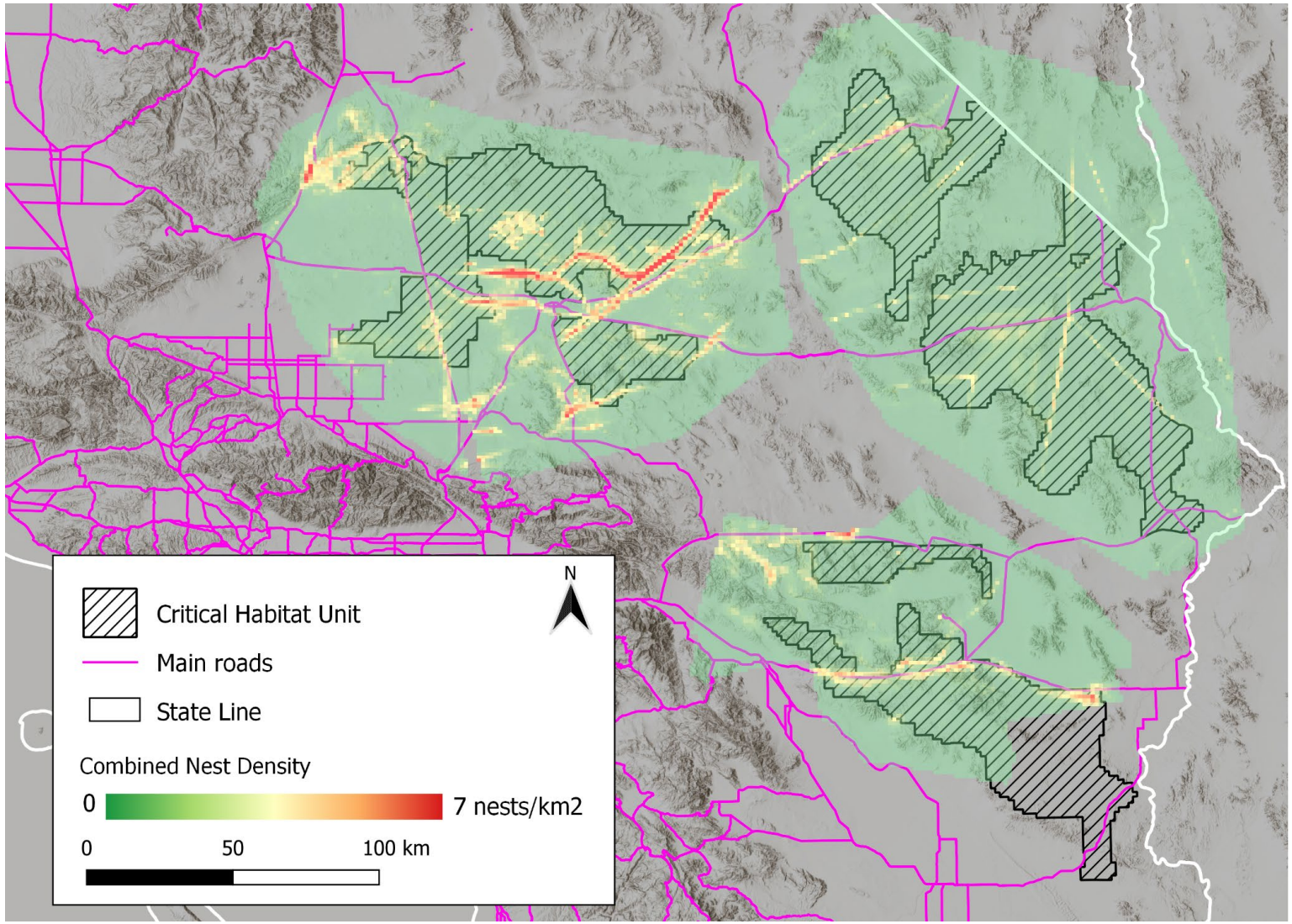
Anthro Substrate Model



Natural Substrate Model

Result: Nest Density Model





High DT Habitat

Significant for all areas and all nest substrate except for anthropogenic nests in West CHU

Urbanized Areas

Driver for all areas and all substrate except for natural nests in South CHU

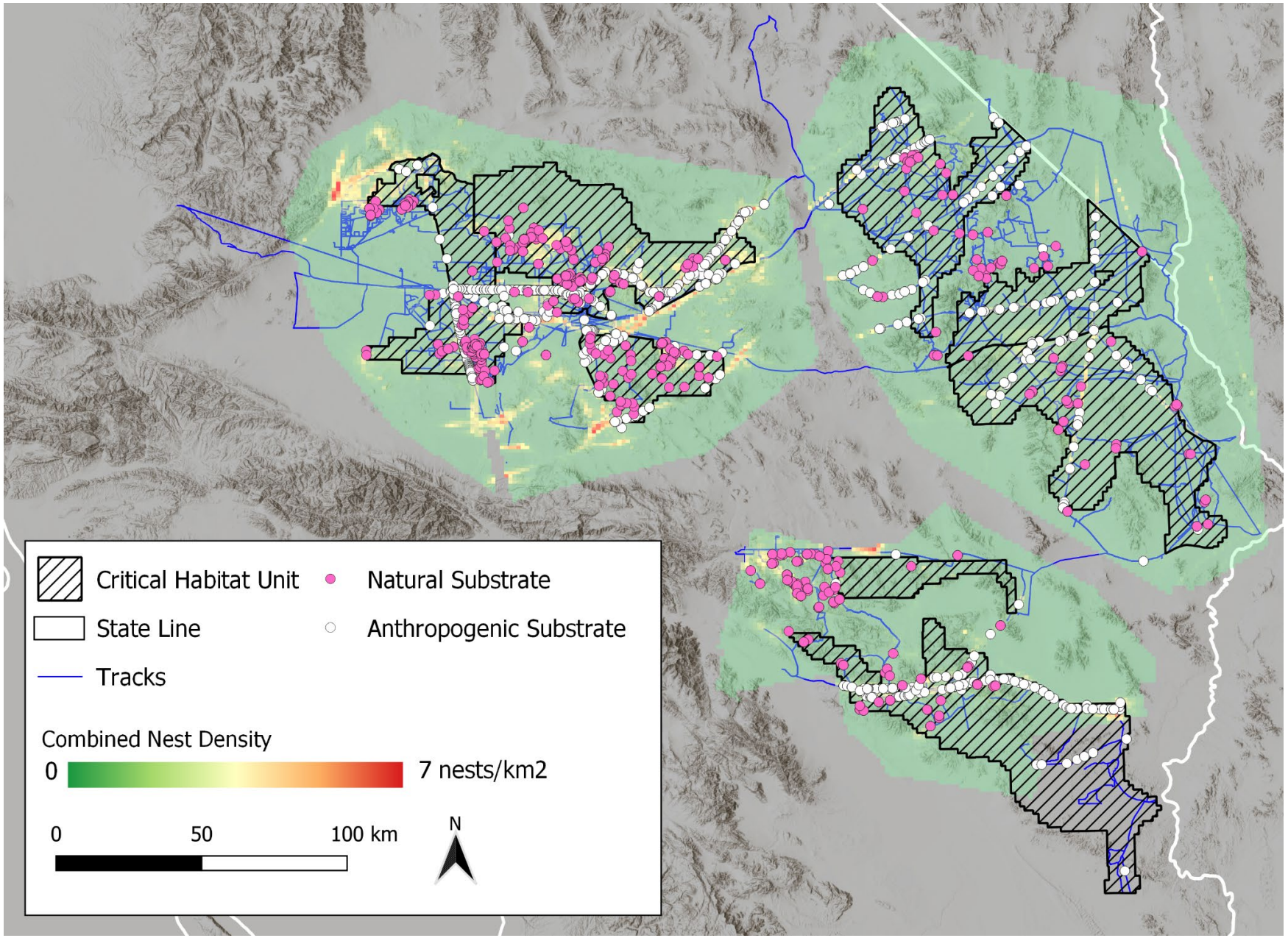
High Surface Texture

Significant for all areas with natural nest substrate

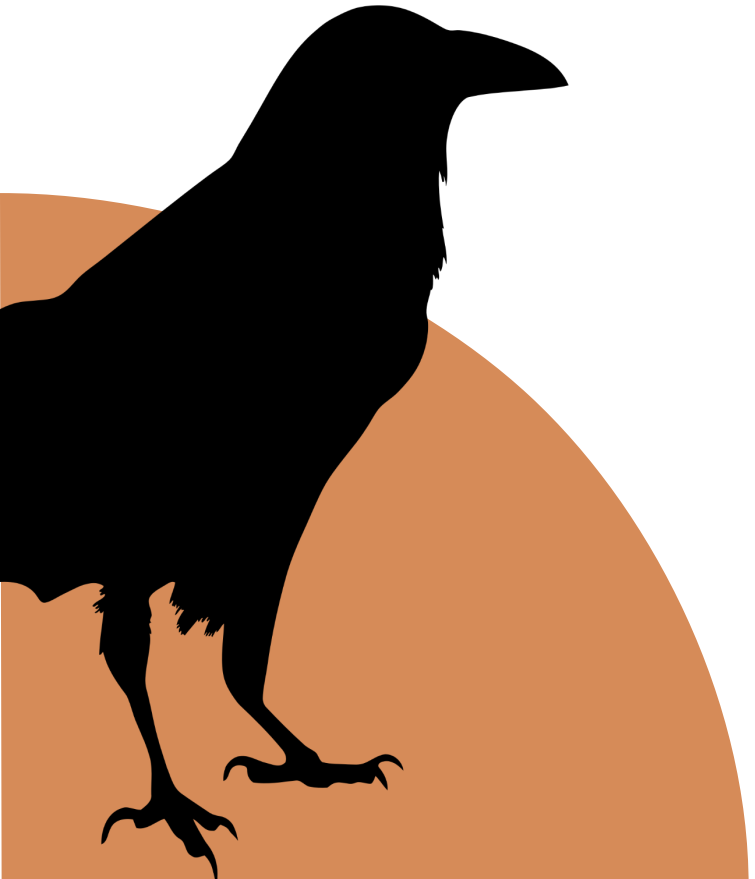
Landfills

Only for natural nests in South CHU

Nest Density Management Implications



Objectives



- Nest Density
- **Nest Success**
- Offending Nests
- Pellet/Diet

Nest Success Methods

Classification

Nest Fate (n=815):

- Completed
- Successful
- Fledgling

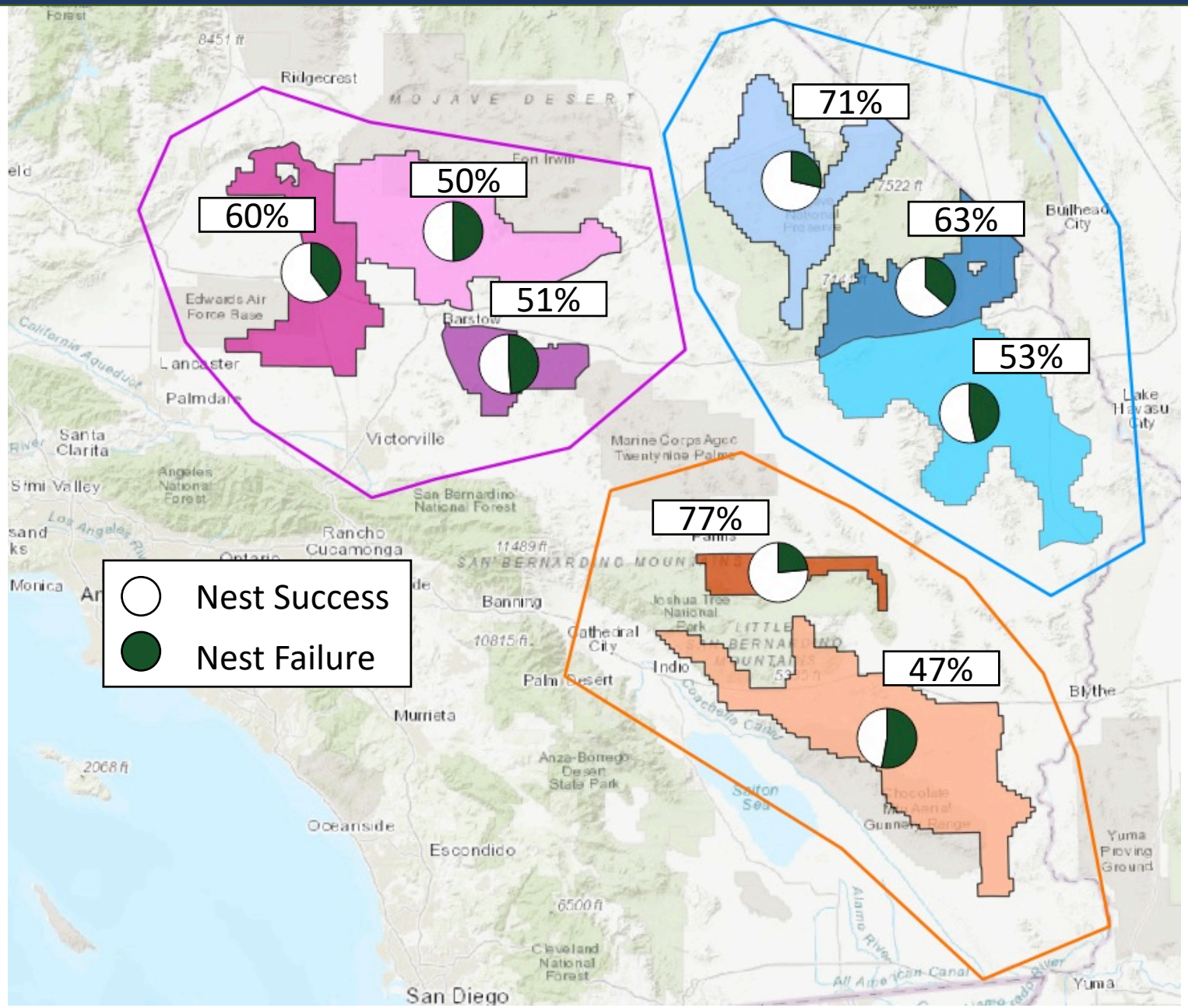
Model:

GAM Binomial logit link function

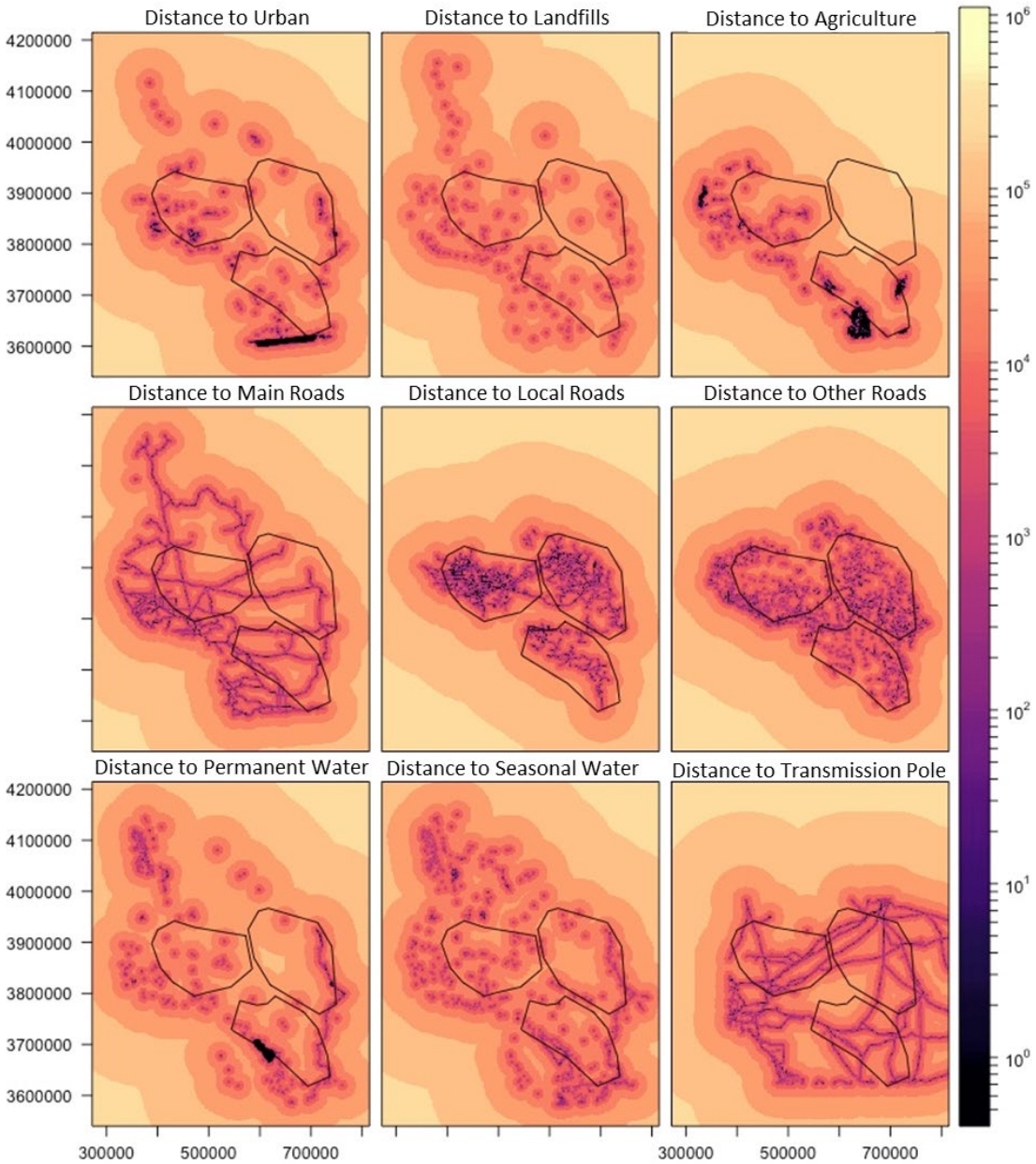
1 = successful nest

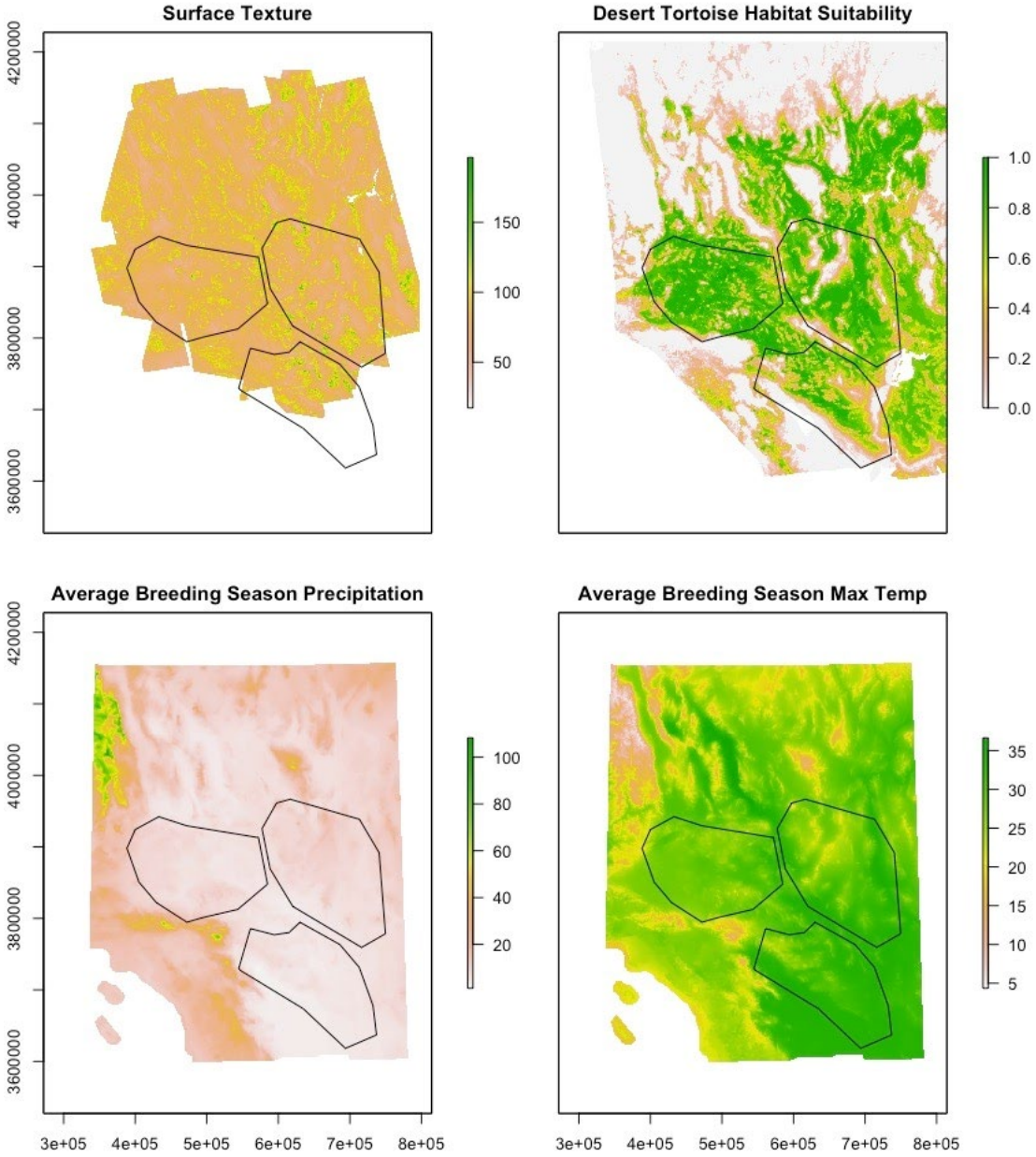
0 = failed nest

Nest Success



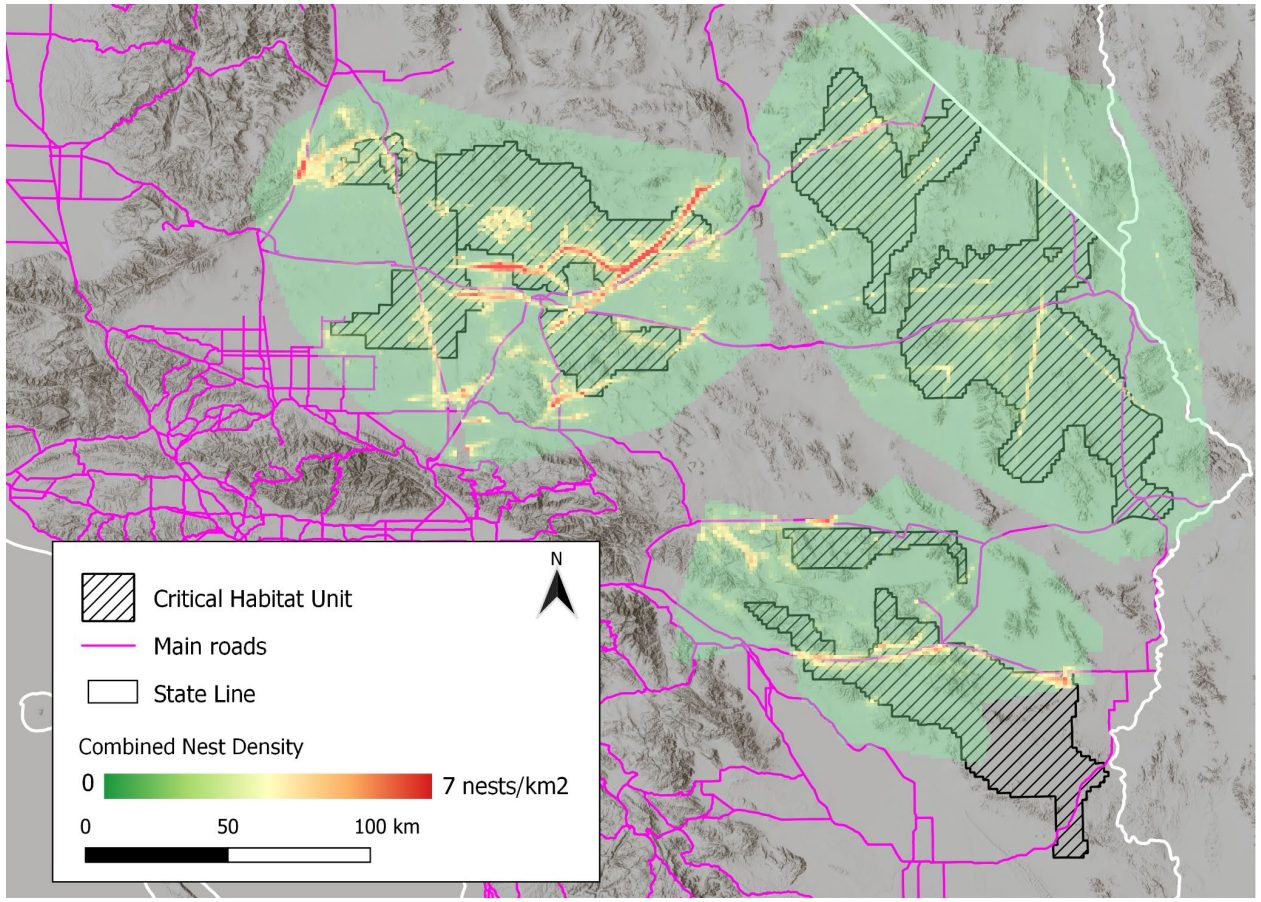
Nest Success Model Covariates

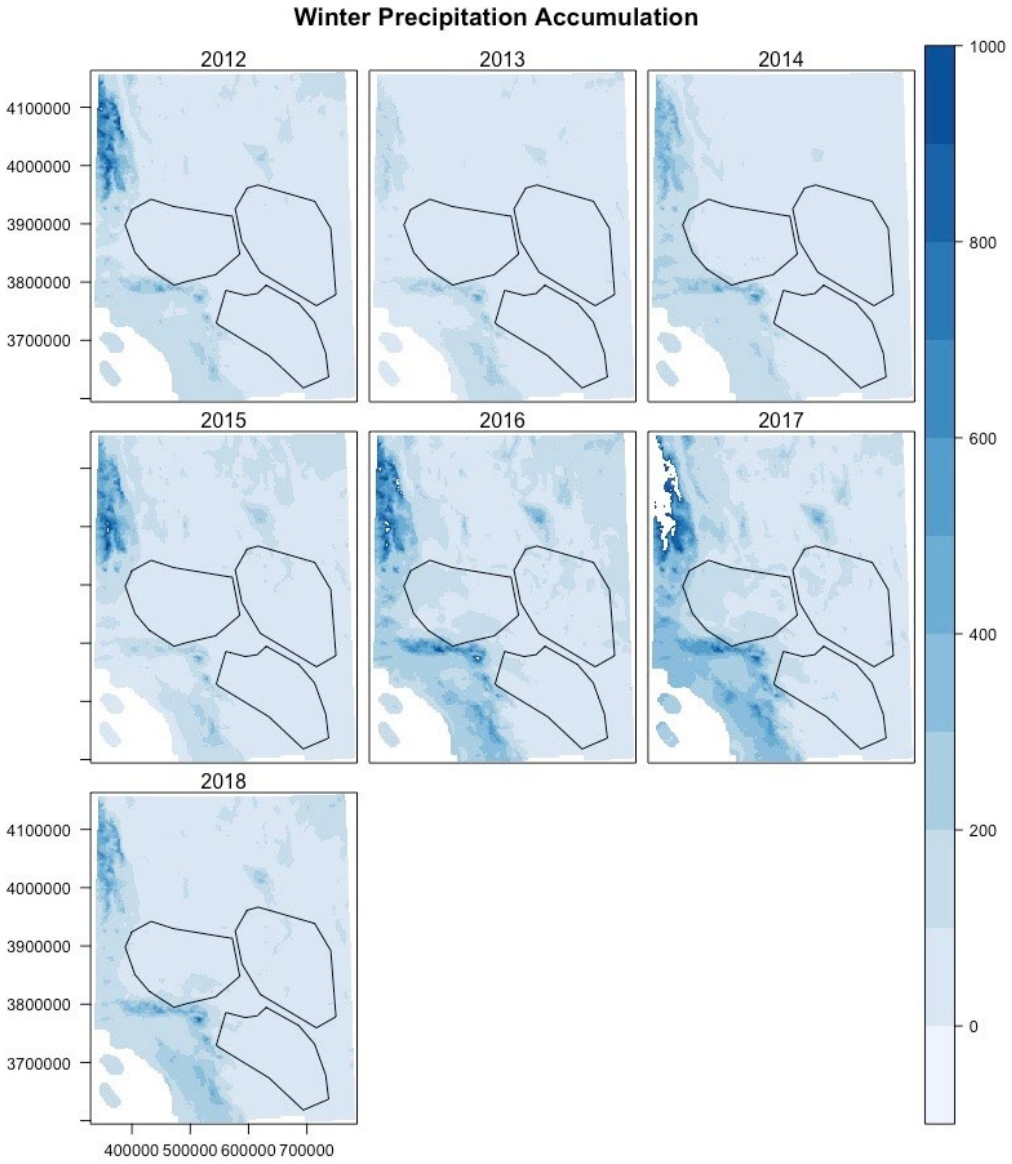




Nest Success Model Covariates

Nest Density



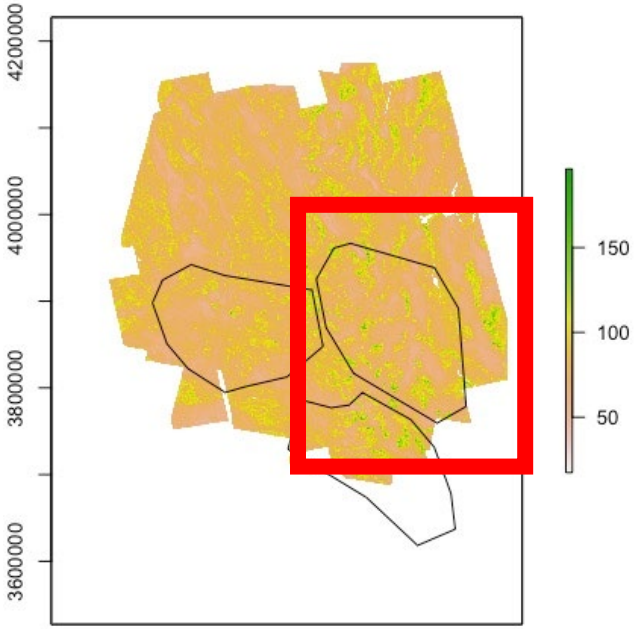


Nest Success Results:

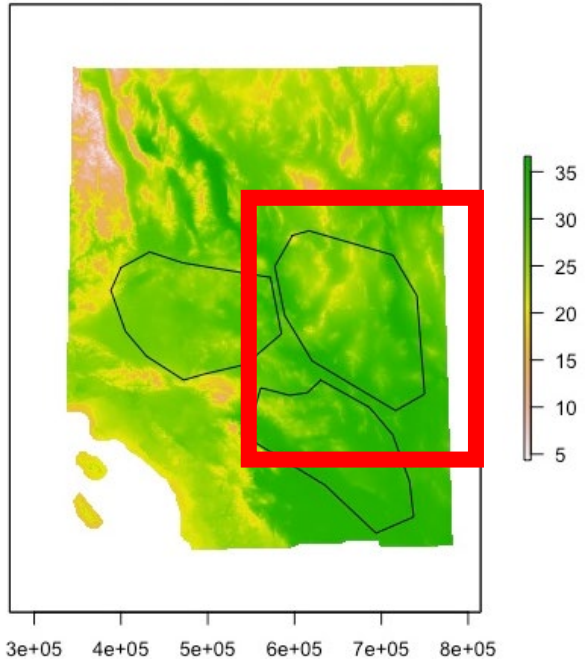
Natural nest substrates were regionally distinct!

Result: East Natural Substrate

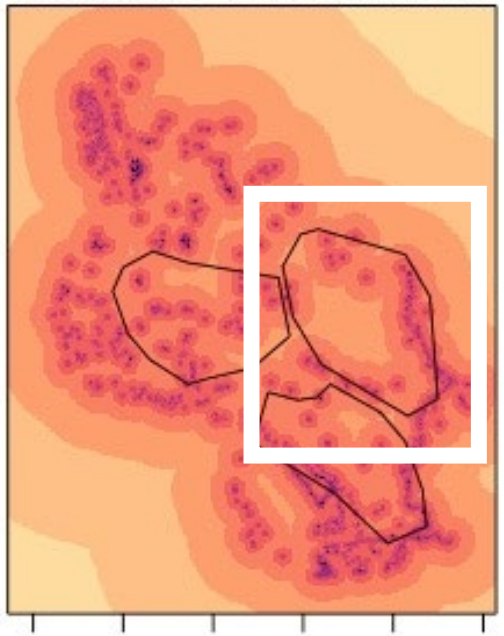
Surface Texture



Breeding season temp.

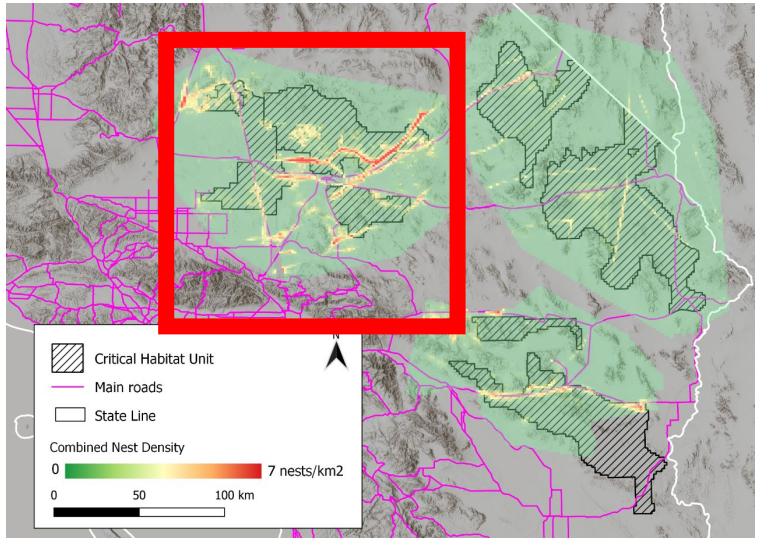


Distance to bodies of water



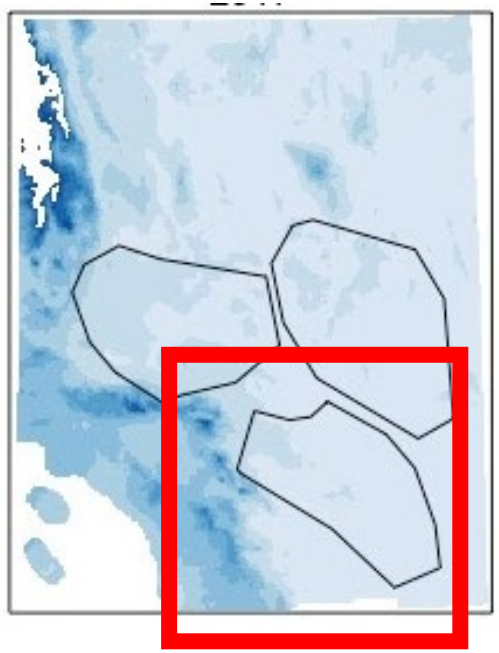
Result: West Natural

Nest Density



Result: South Natural

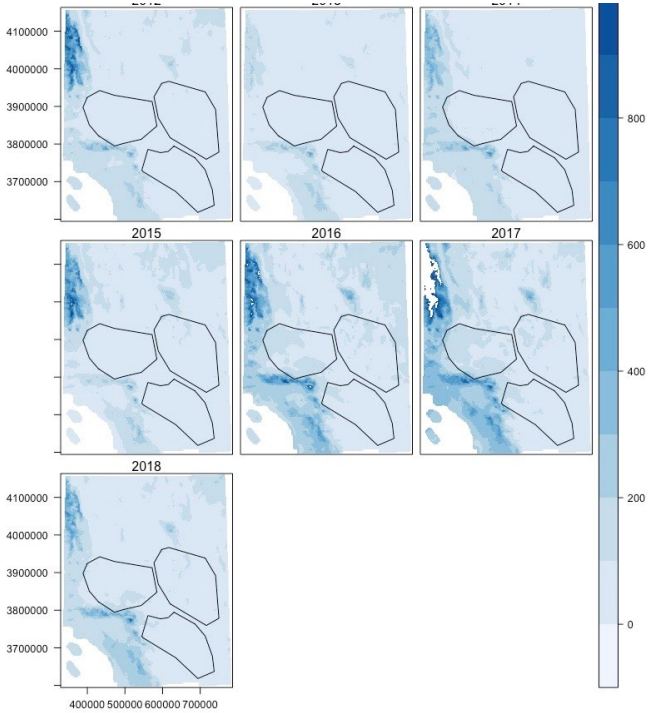
Winter Precip. Accumulation



Anthropogenic Nest Substrate

All 3 CHU groups

Winter Precip. Accumulation

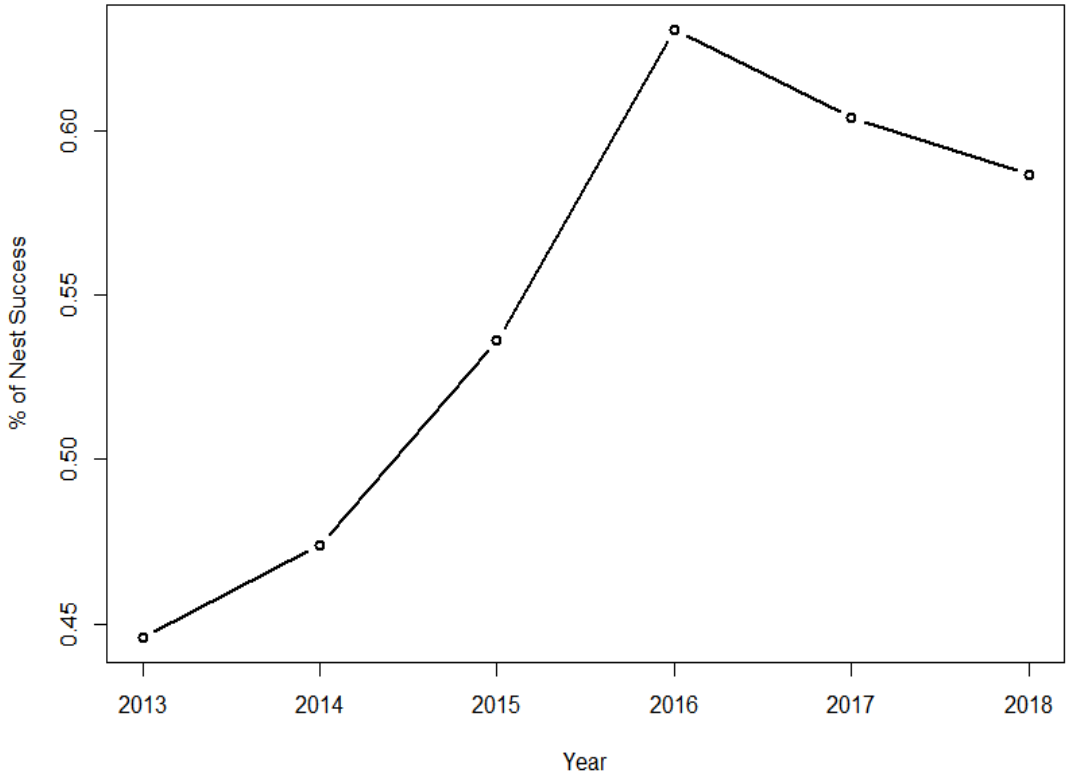


Time Series Method

CHU and NPS units	2013	2014	2015	2016	2017	2018
Superior-Cronese CHU/Ft. Irwin Conservation Area	Phase 1				Phase 2	
Chemehuevi CHU		Phase 1			Phase 2	
Chuckwalla CHU **	Phase 1				Phase 2	
DTRNA	Phase 1					includes Fremont-Kramer
Mojave NP/Ivanpah CHU/Fenner CHU				Phase 1		
Joshua Tree NP/Pinto Mountains CHU				Phase 1		Phase 2
Ord-Rodman CHU				Phase 1		Phase 2
Fremont-Kramer CHU (includes EAFB and DTRNA)					Phase 1	

Time Series Analysis

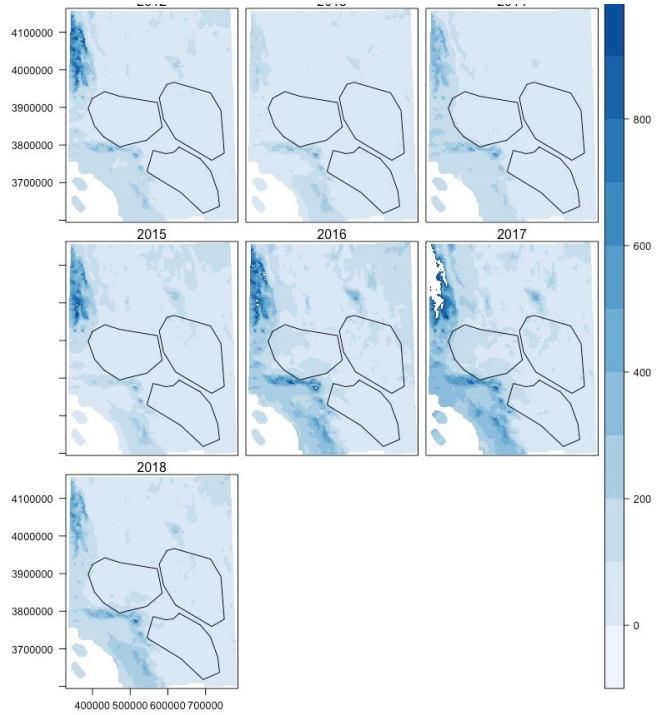
- Varying sampling efforts



Anthropogenic Nest Substrate

All 3 CHU groups

Winter Precip. Accumulation

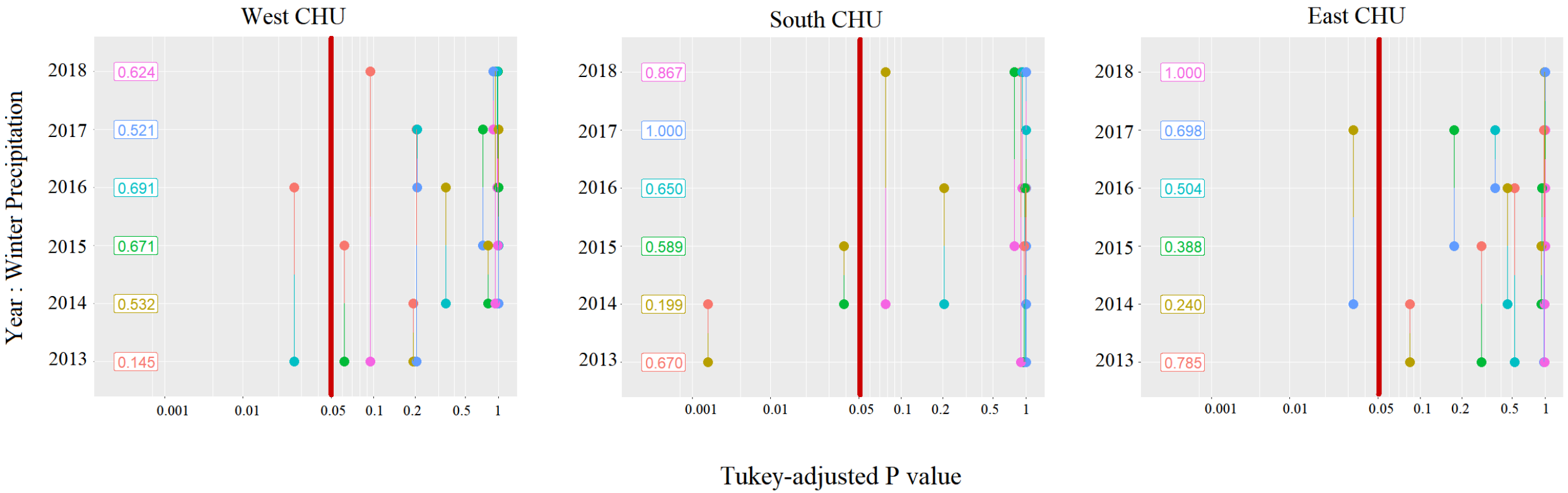


Time Series Analysis - Post-hoc Tukey HSD

- Unique Nest ID
  - 5 meters among years
- Success model covariates + year + ID (random factor)

Anthropogenic Nest Substrate Success – Time Series Result

Alpha = 0.05, C.I. = 95%



No significant differences on nest success after 2014

Objectives

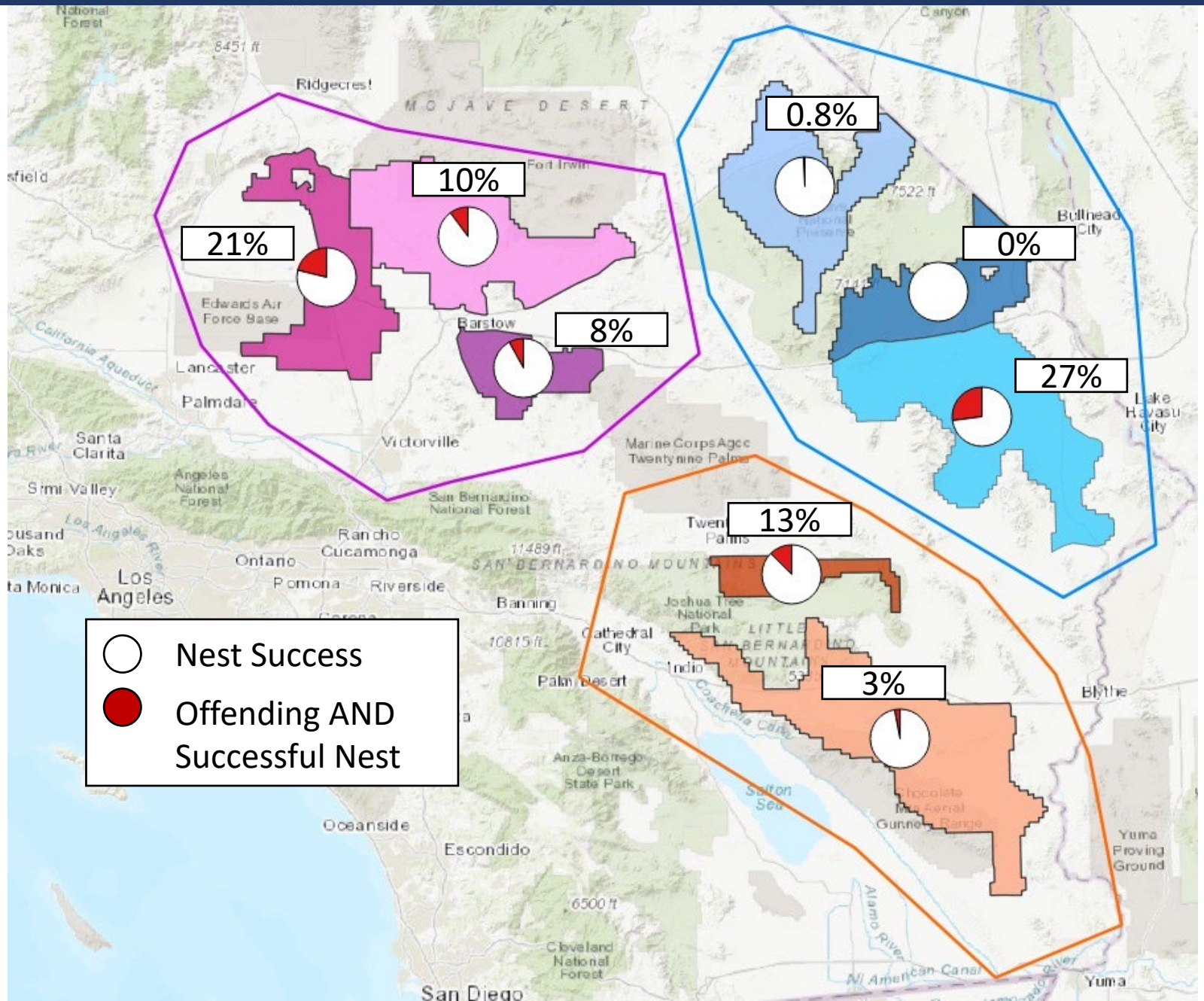
Nest Density

Nest Success

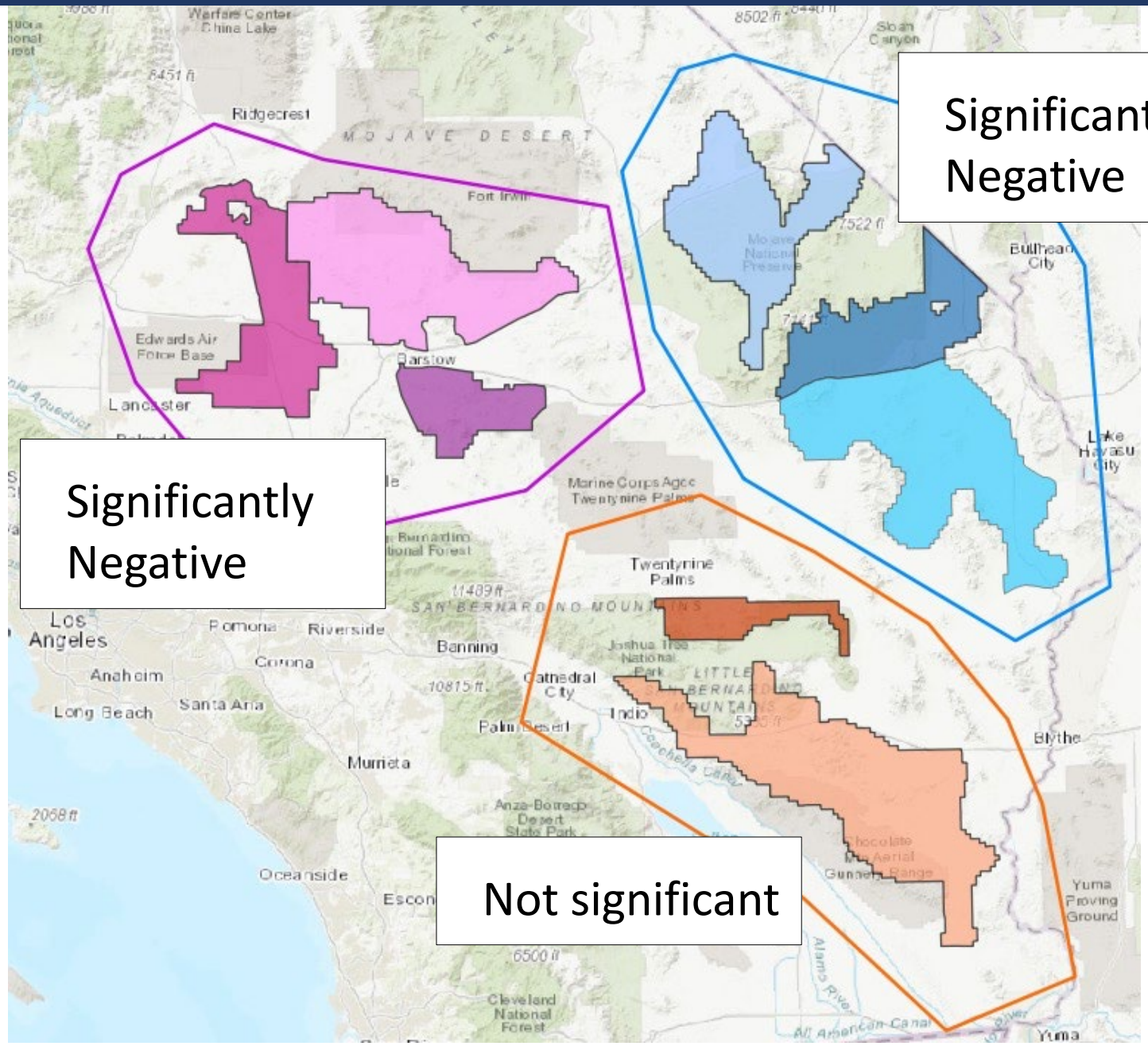
Offending Nests

Pellet/Diet

Offending and Successful Nest



Offending and Successful Nest



Objectives

Nest Density

Nest Success

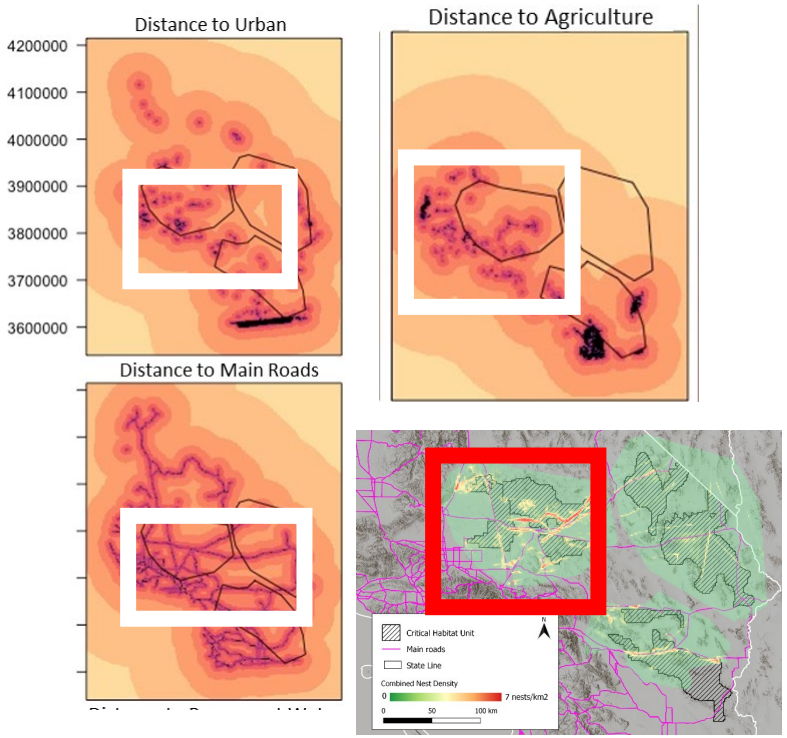
Offending Nests

n = 117

Pellet/Diet

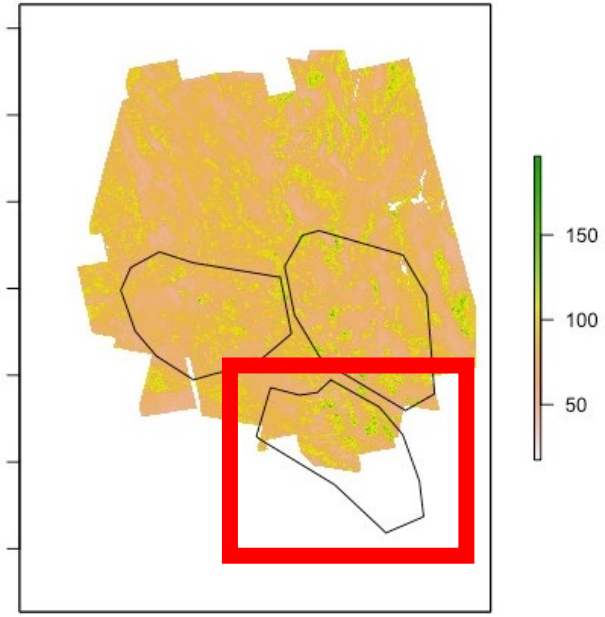
West Nat/Anthro

- Distance to Subsidies: Roads, Urban Areas, and Agriculture
- Nest Density



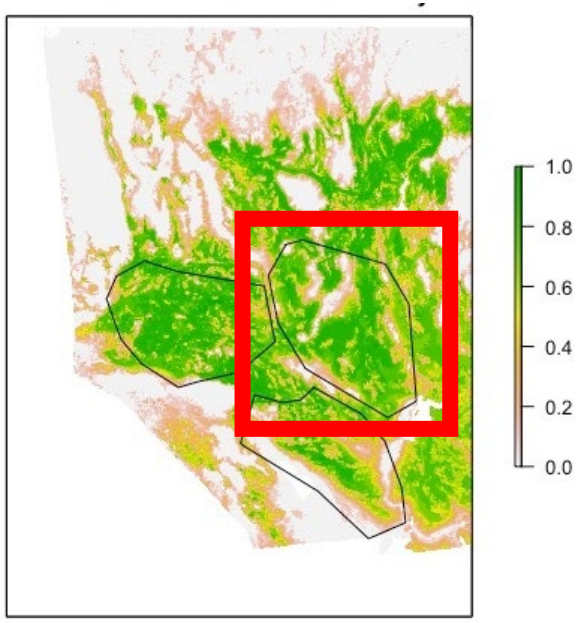
South Natural

Surface Texture



East Nat/Anthro

Desert Tortoise Habitat Suitability



Objectives

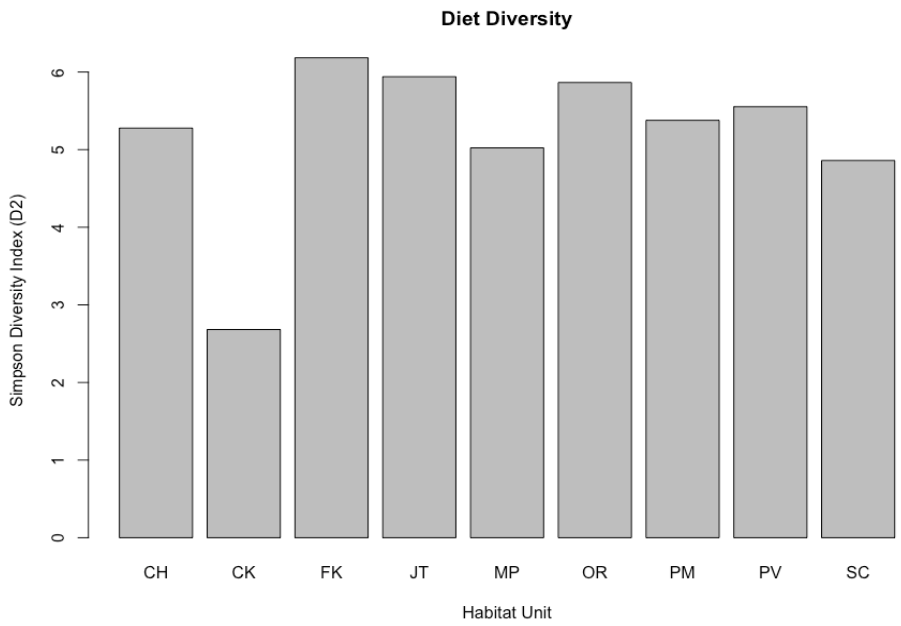
Nest Density

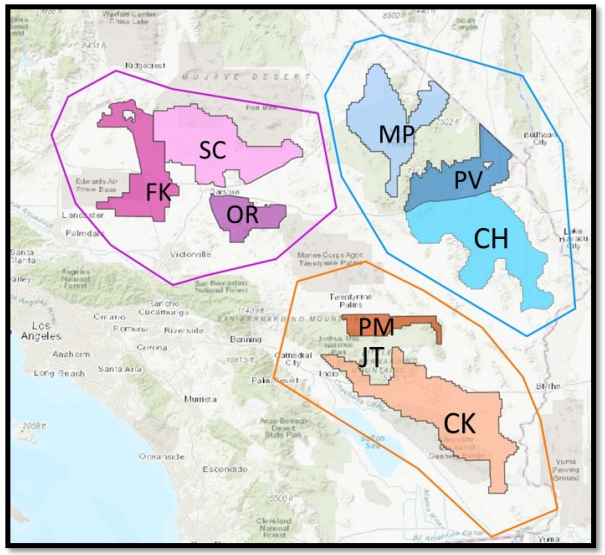
Nest Success

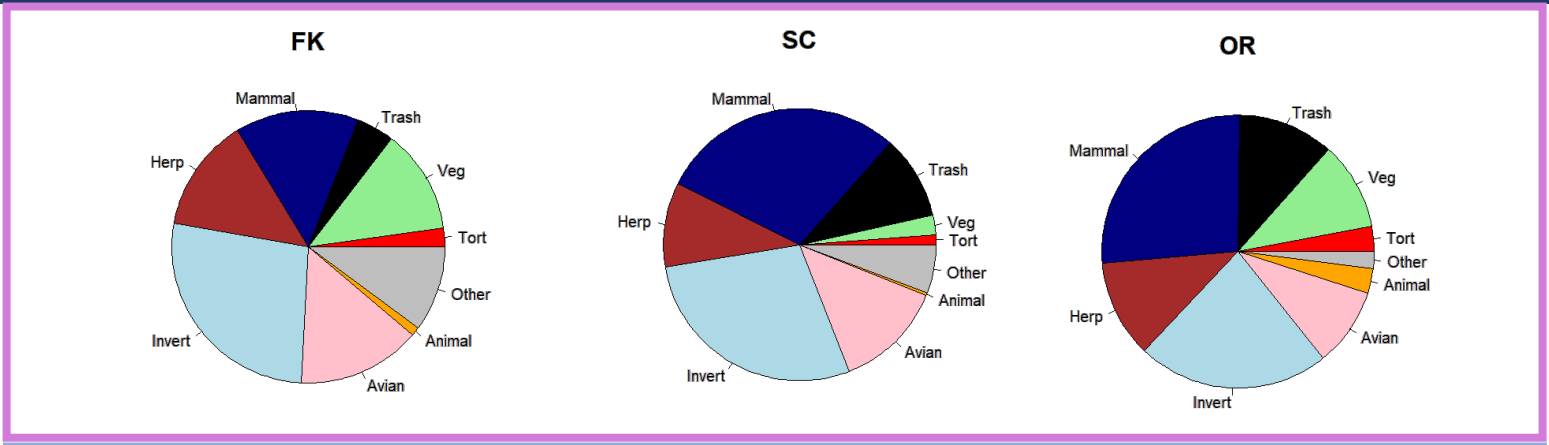
Offending Nests

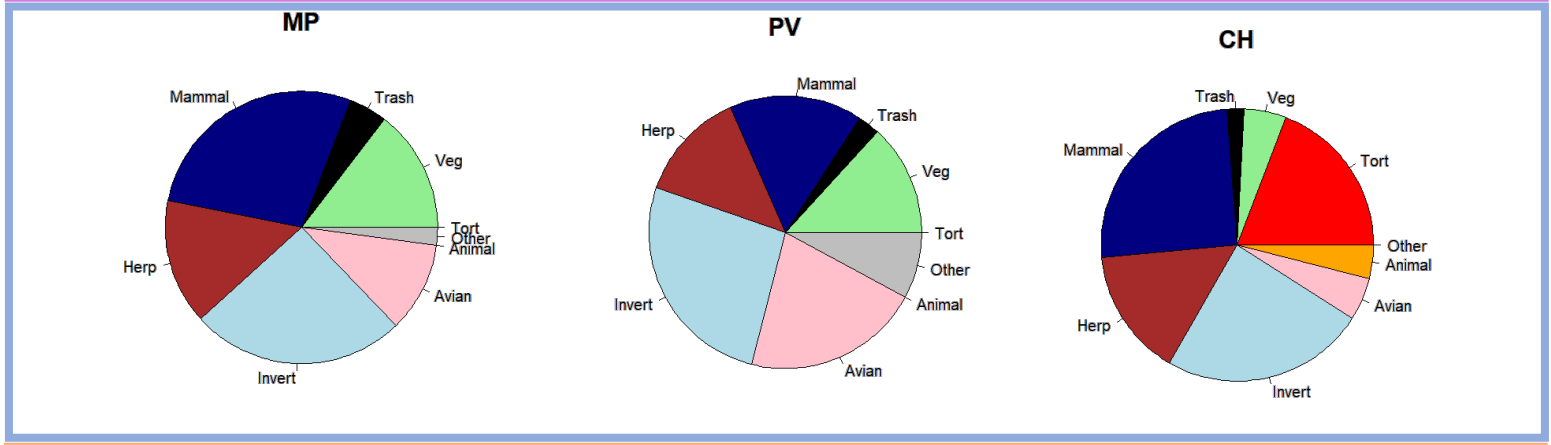
Simpson's Diversity Index → Pellet/Diet (n=1571)

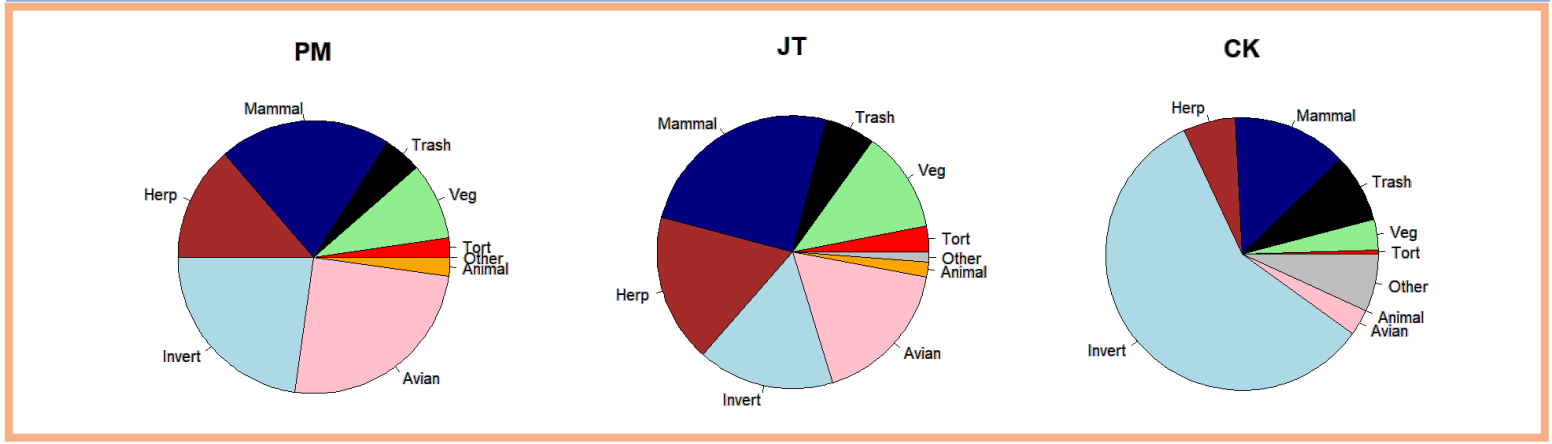
CORA Pellet Analysis



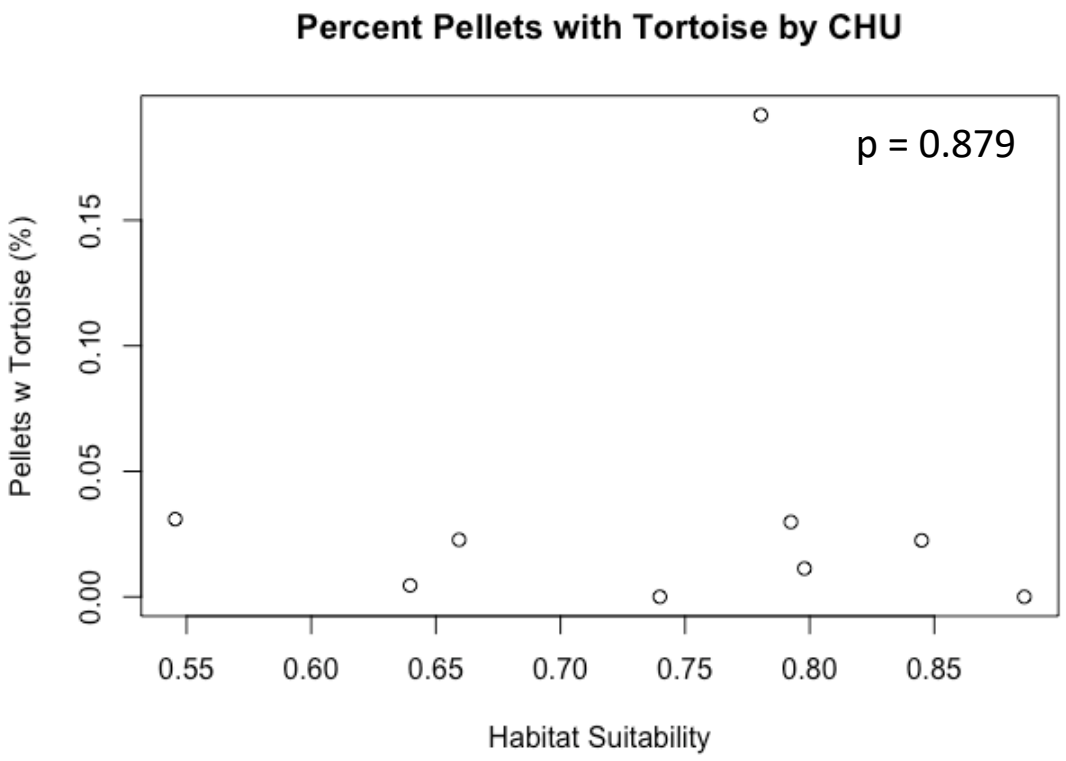


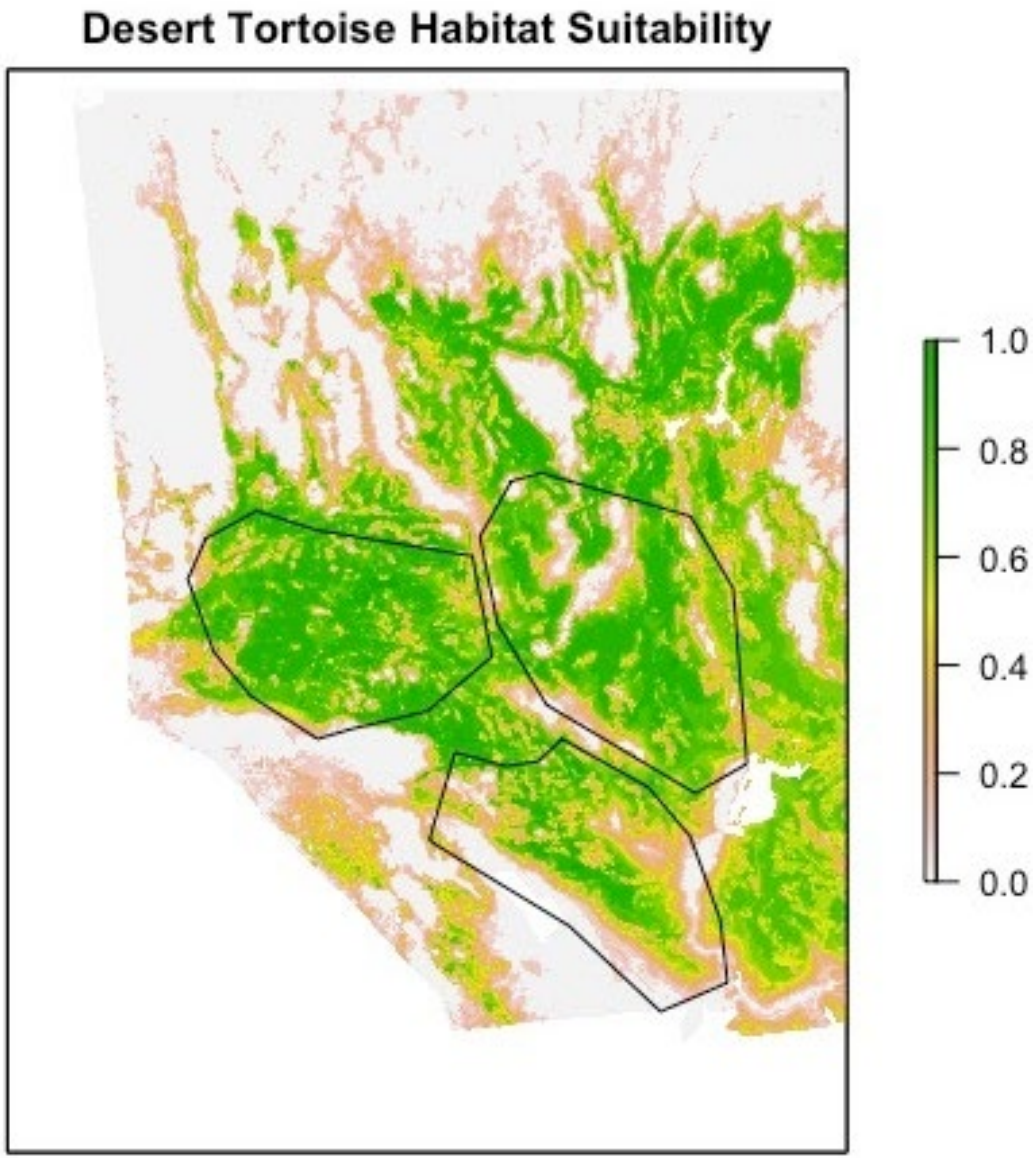






CORA Pellet Analysis – Simpson Diversity Index



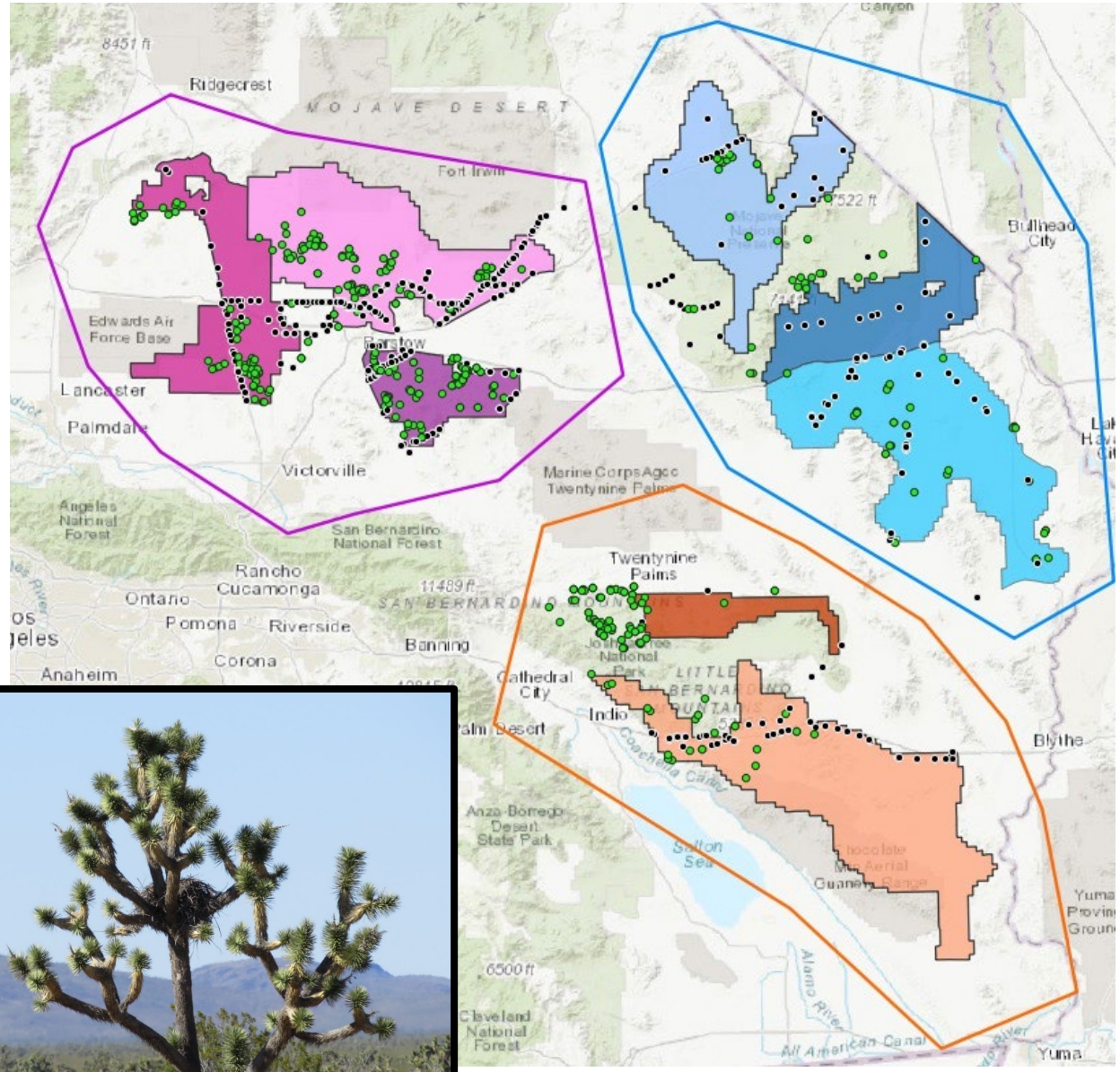


Nest Success and Offending Management Implications

Manage each CHU differently for natural substrate

<u>Natural substrate</u>

- West - low nest density
- South – high winter precipitation
- East – bodies of water, low temp, high surface texture



Nest Success and Offending Management Implications

Anthropogenic substrate

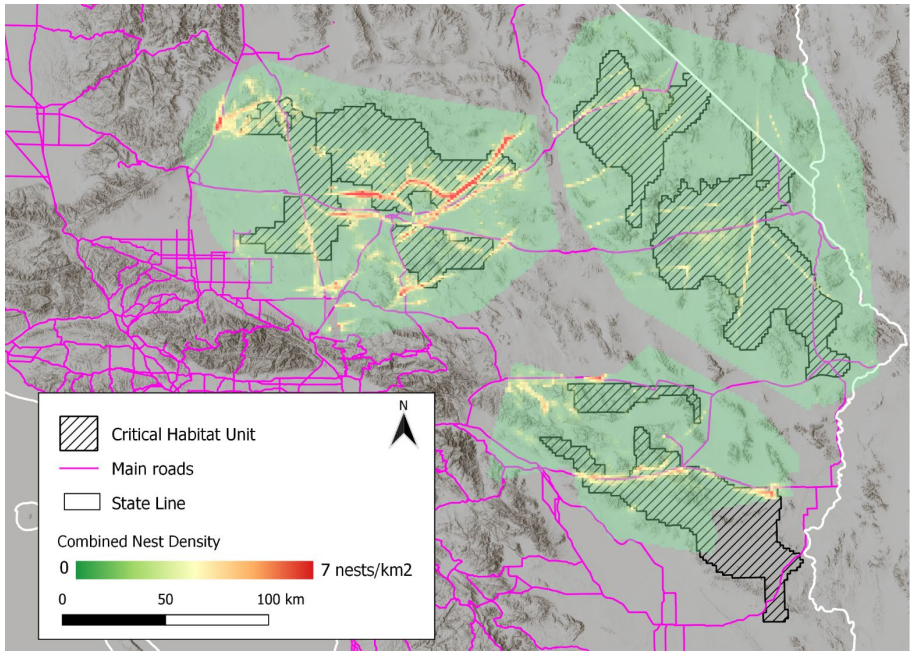
- Winter precipitation
  - Increase removal/oiling methods on nest when winter precipitation is above average (>29mm)
    - Oiling techniques > removal

	Removal/ WS action	Removal/WS action nest success	Nests Oiled	Oiled Nest Success
Total	199	25	52	0

Nest Density Management Implications

Approximately seven Raven nest

- Success increase with lower density
- Offending nest (natural substrate) increase with higher density



Thank you!