

Factors Associated With Cactus Wren Reproduction at the Nature Reserve Of Orange County, 2009-13



Photo Joshua Sudock, OC Register

Kristine Preston & “Team Cactus Wren”



Acknowledgements – “Team Cactus Wren”

Monitoring Team

- Dana Kamada
- Karly Moore
- Scott Thomas
- Dr. Milan Mitrovich
- Sea & Sage Audubon (esp. Dr. Elizabeth Brown, Sandy DeSimone, Sally Menzel & Kathy Young)
- Crystal Cove State Park Staff
- Trish Smith, The Nature Conservancy

Translocation & Disease Investigation

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- Dr. Jutta Burger, Irvine Ranch Conservancy
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- Environmental Enhancement & Mitigation Program
- NROC Board of Directors
- NROC Directors: Lyn McAfee & Jim Sulentic
- NROC Technical Advisory Committee
- Orange County Transportation Authority
- USFWS (Will Miller, Jonathan Snyder)



Photo Trish Smith

More Acknowledgements– “Team Cactus Wren”

NROC Land Owners/Managers/Cactus Restoration Experts

- Crystal Cove State Park (esp. David Pryor & Lana Meade)
- City of Irvine
- City of Newport Beach
- Irvine Ranch Conservancy
- Irvine Ranch Water District
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- Southern California Edison
- Transportation Corridor Authority (Valerie McFall)
- UC Irvine Office of Campus & Environmental Planning/Ecological Preserve (Dr. Peter Bowler & Alex Marks)



Regional Collaborators

- Cactus Wren Working Group
- Institute for Conservation Research
- San Diego Association of Governments
- San Diego Monitoring & Management Program (Yvonne Moore & Ron Rempel)
- USGS (Kelly Barr, Dr. Barbara Kus, Dr. Amy Vandergast)

NATURE RESERVE OF ORANGE COUNTY (NROC):

- Orange County's Central & Coastal NCCP/HCP
- Established 1996
- >37,000 acres conserved





Photo Christine Beck

NROC Conserves 4,100 Acres Of Cactus Scrub



Santiago Fire – 10-07, CBS News Photo

1993 Laguna Fire
burned 75% of
Coastal Reserve

*2007 Santiago Fire
burned 75% of
Central Reserve*

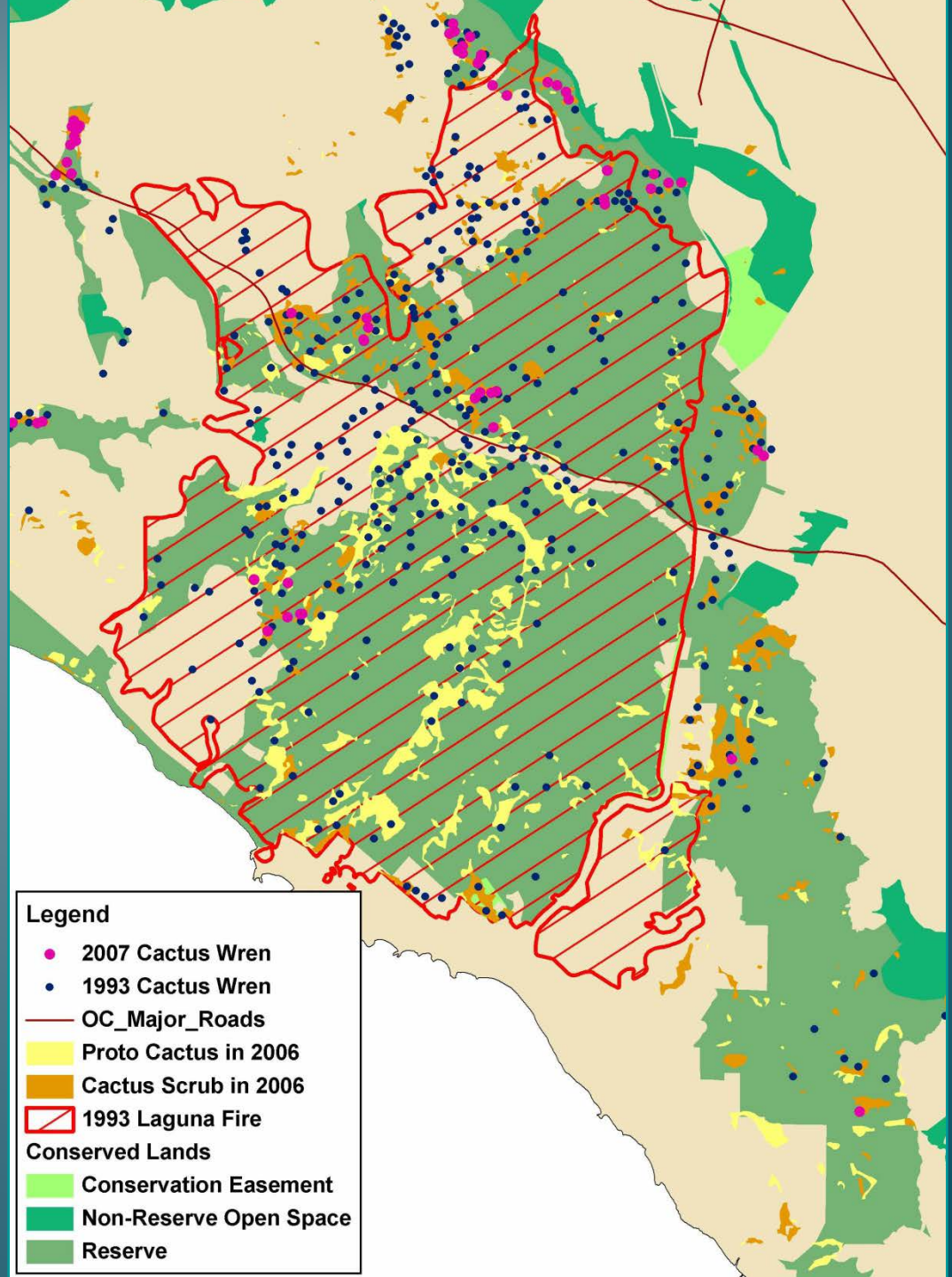


Santiago Fire – 10-07, CBS News Photo

Coastal Reserve

NROC mapped
cactus & wrens
13 years after the
Laguna Fire
(2006-2007)

- 2,323 acres cactus scrub, 58% unsuitable for wrens
- 187 acres occupied in 2006 vs. estimated 1,470 in 1992 (87% ↓)
(Mitrovich & Hamilton 2007)

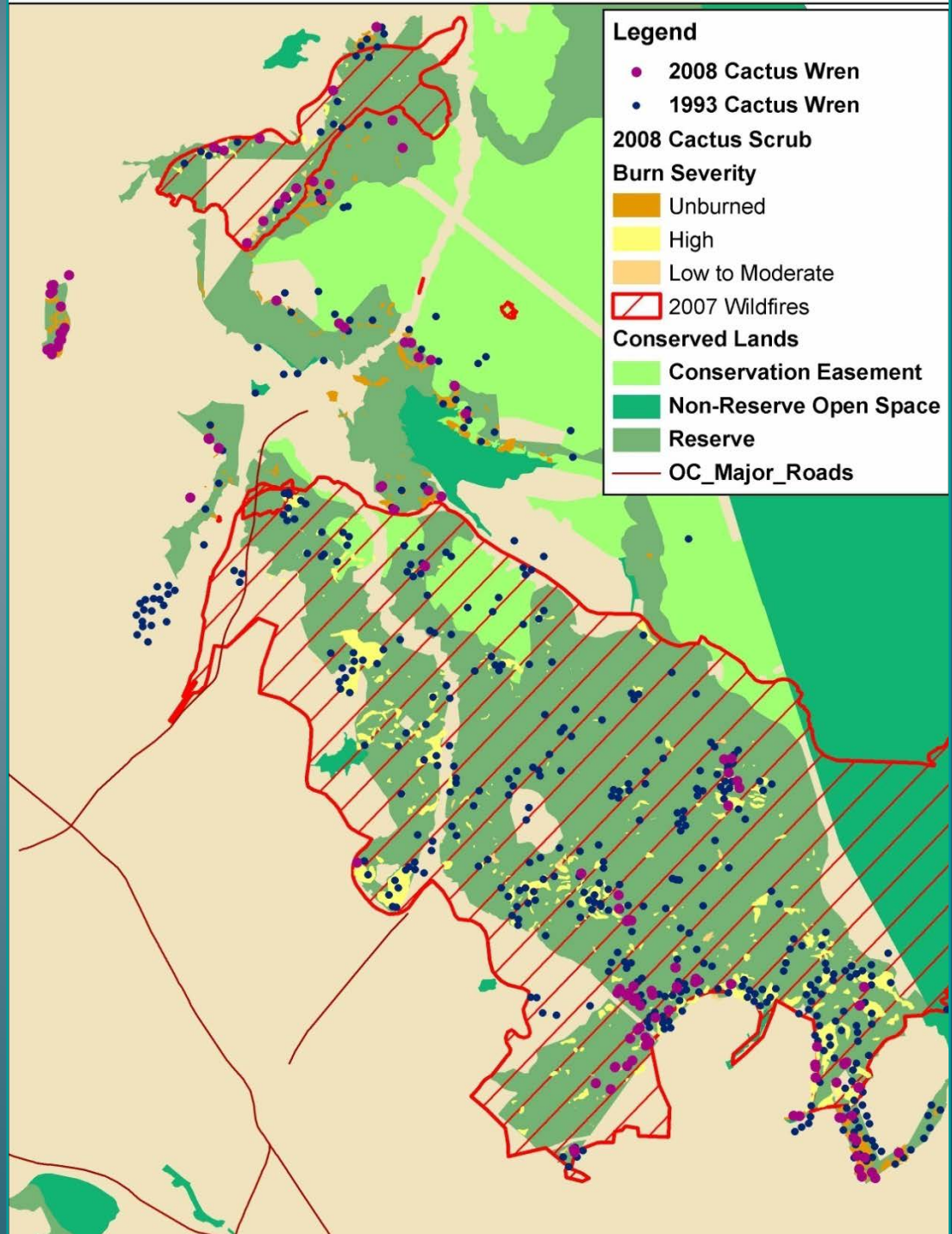


Central Reserve

NROC mapped cactus & wrens first year after Santiago Fire (2008)

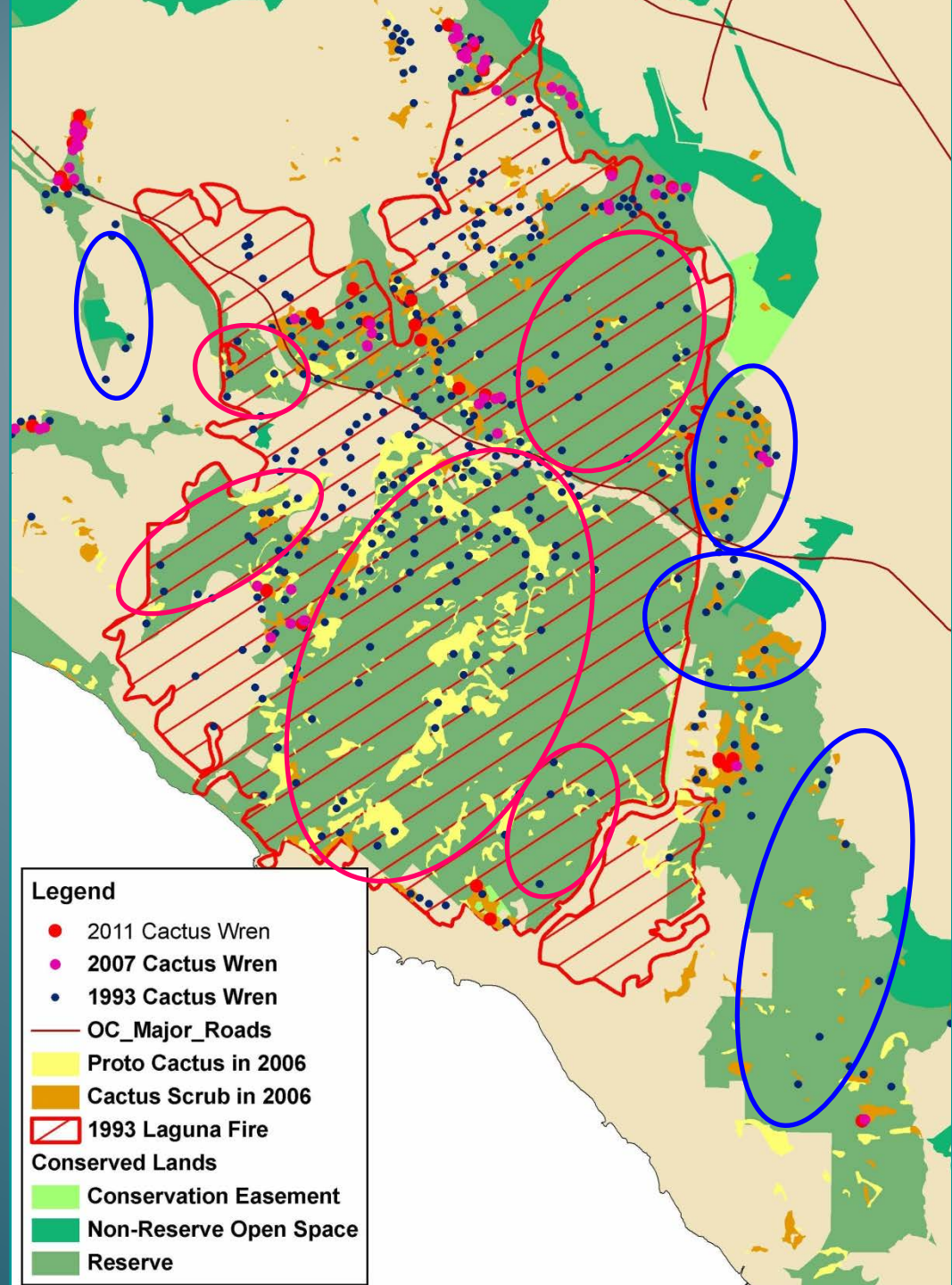
- 1,855 acres cactus scrub, 77% burned
- 683 acres suitable for wrens
- ~67 territories (est. 82%↓)

(Leatherman BioConsulting 2009)



Cactus Wren - disappeared from burned & unburned areas of the Coastal Reserve

- *Missing from
burned areas*
- *Missing from
unburned areas
(not shown is
Newport Back Bay)*



Why Are Cactus Wren Populations Declining & Disappearing?



Photo Joshua Sudock, OC Register

Potential Factors Contributing to the Cactus Wren's Decline

- Low productivity
food limitation, nest predation
- Low survivorship
predation, disease
- Isolated small populations
vulnerable to local extinction with limited dispersal & recolonization
- Insufficient suitable habitat
habitat has not recovered since fires or has changed in composition & structure



Photo Karly Moore

NROC Monitoring Study

Objectives:

- *Monitor individual productivity & annual survival*
- *Monitor dispersal & recruitment of individuals into local populations*
- *Identify threats to the persistence of Cactus Wren*
- *Collect genetic material for connectivity & taxonomic analyses*



Photo Maria Carillo



Photo Karly Moore

Monitoring Effort

Reproductive Monitoring:

- 2009 – 34 territories, 5 sites
- 2010 – 50 territories, 9 sites
- 2011 – 60 territories, 9 sites
- 2012 – 16 territories, 5 sites
- 2013 - 17 territories, 8 sites



2009-13 Periodically surveyed 9 monitoring + 7 nearby sites for dispersal & survival

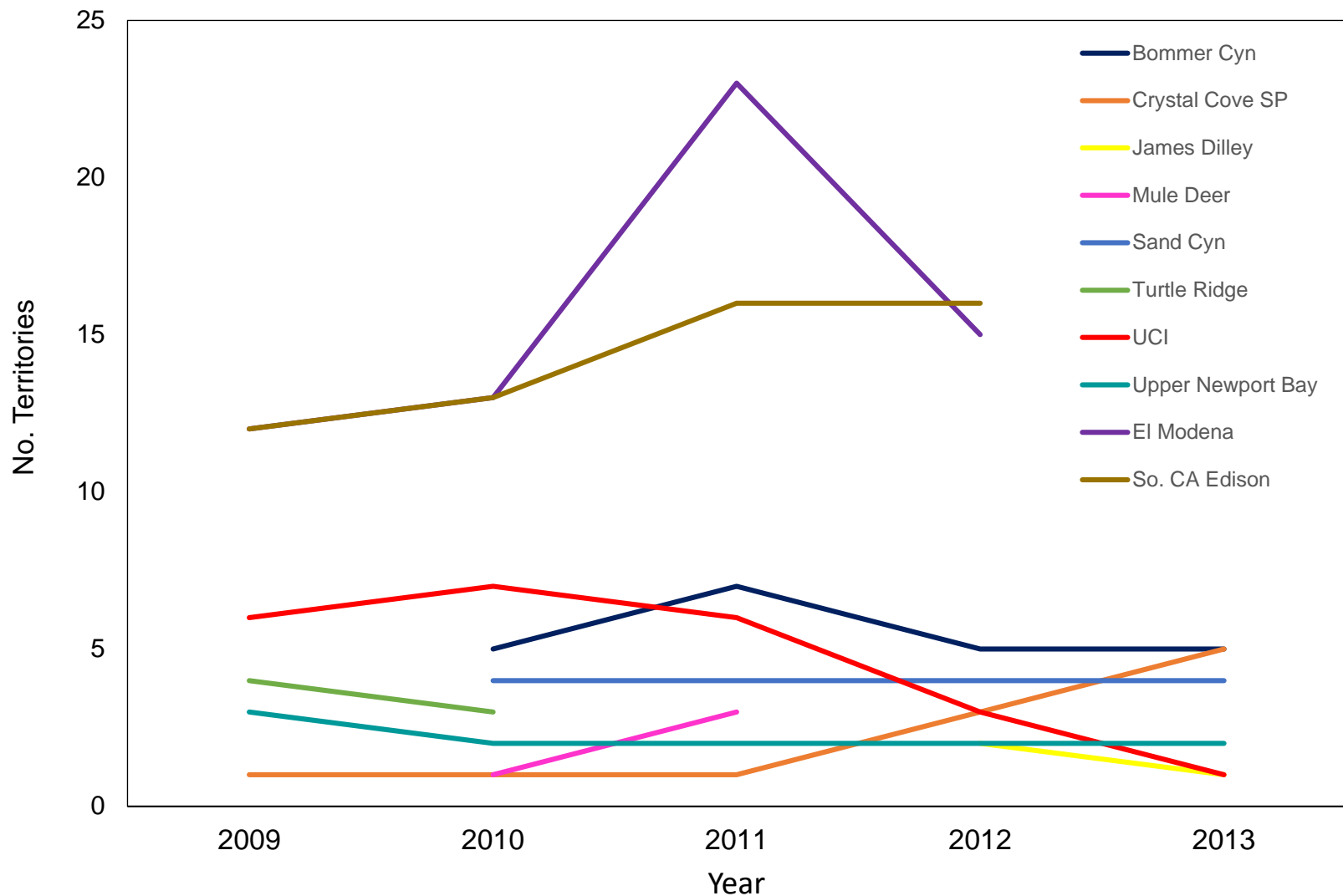
Banded 697 birds:

94 adults banded & monitored

494 HYs banded & monitored

109 adults & HYs banded but not monitored (genetics study)

Number Of Territories By Site – 2009-2013



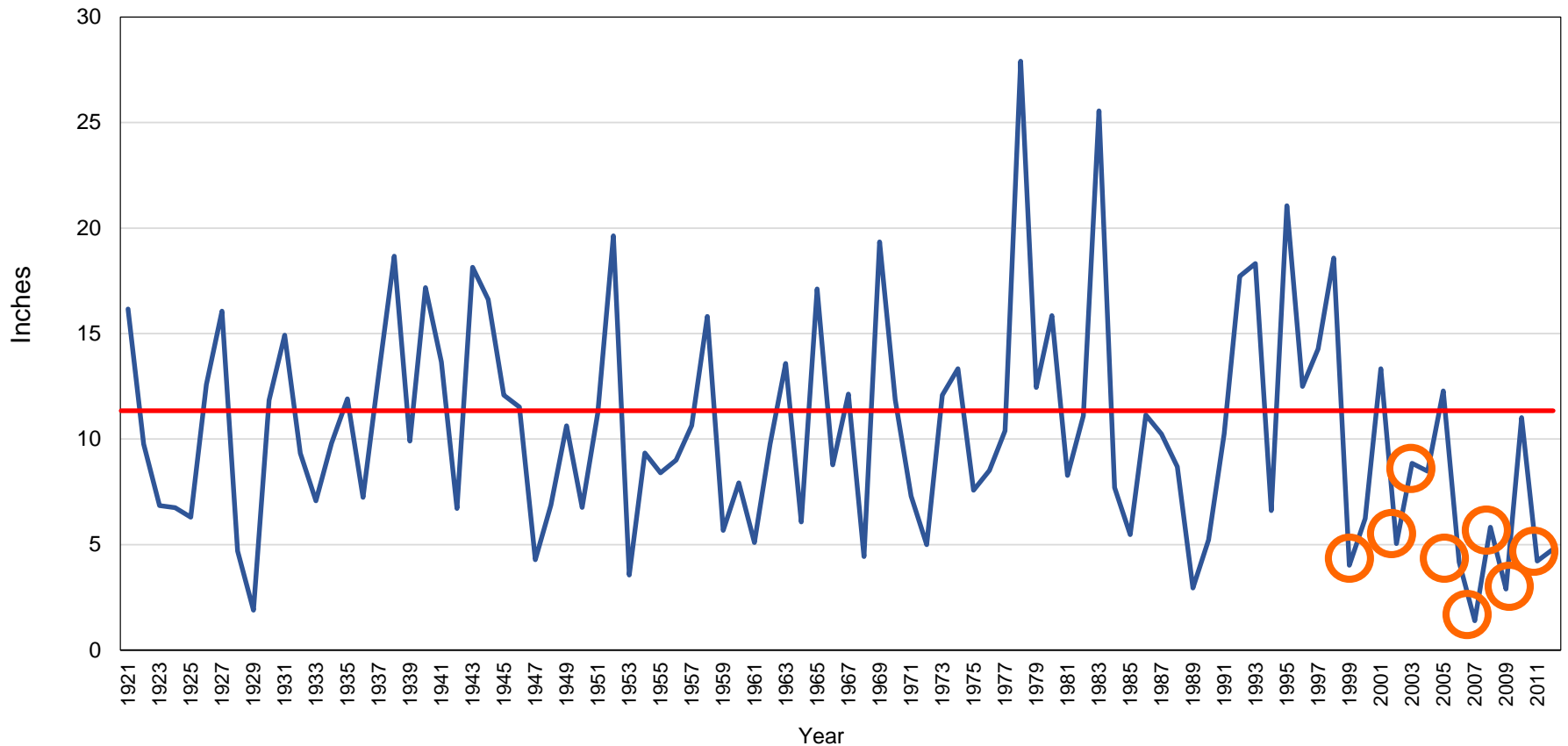
Measuring Cactus Wren Productivity



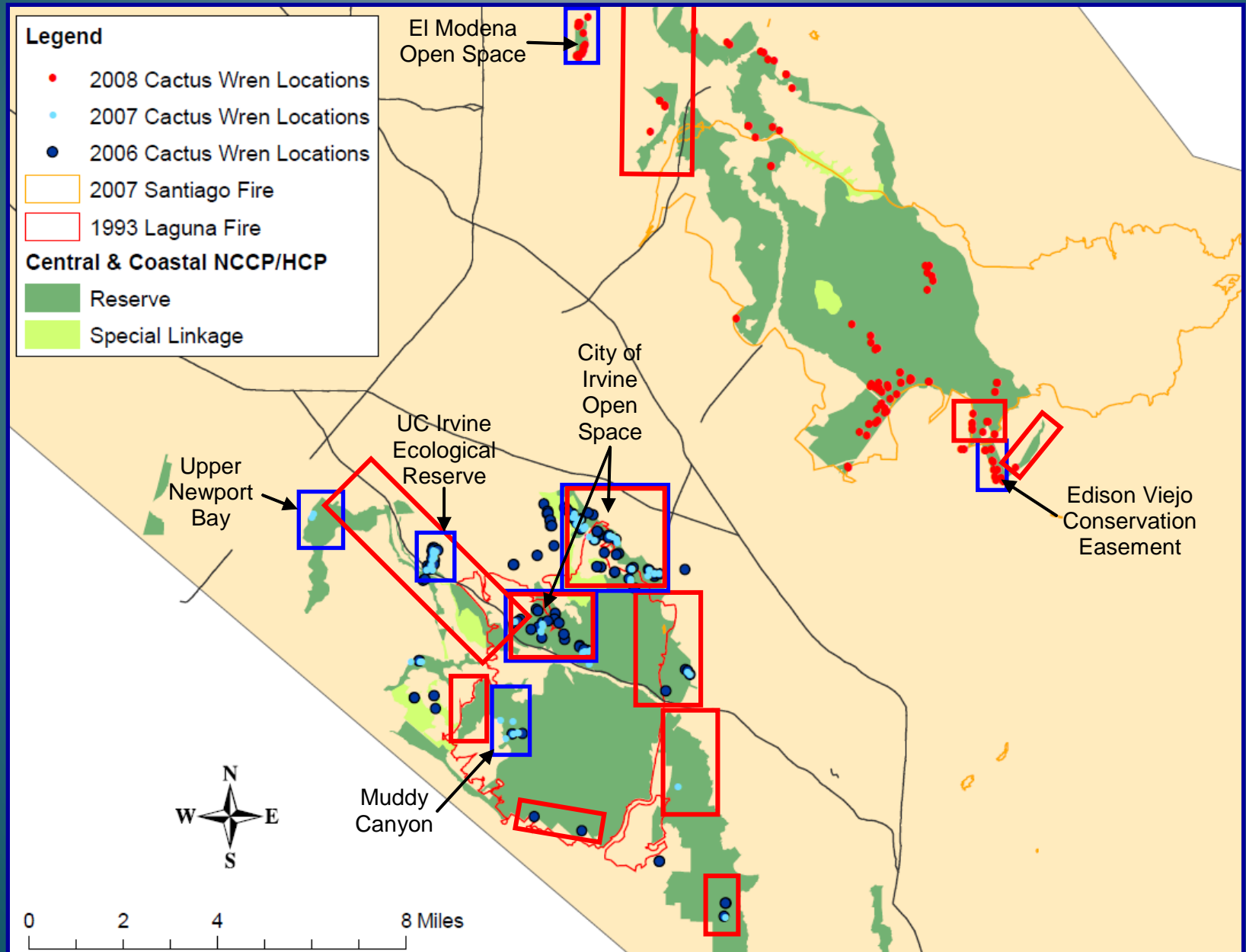
Photo Karly Moore

How Important Are Nest Predation & Food Limitation In Cactus Wren Productivity?

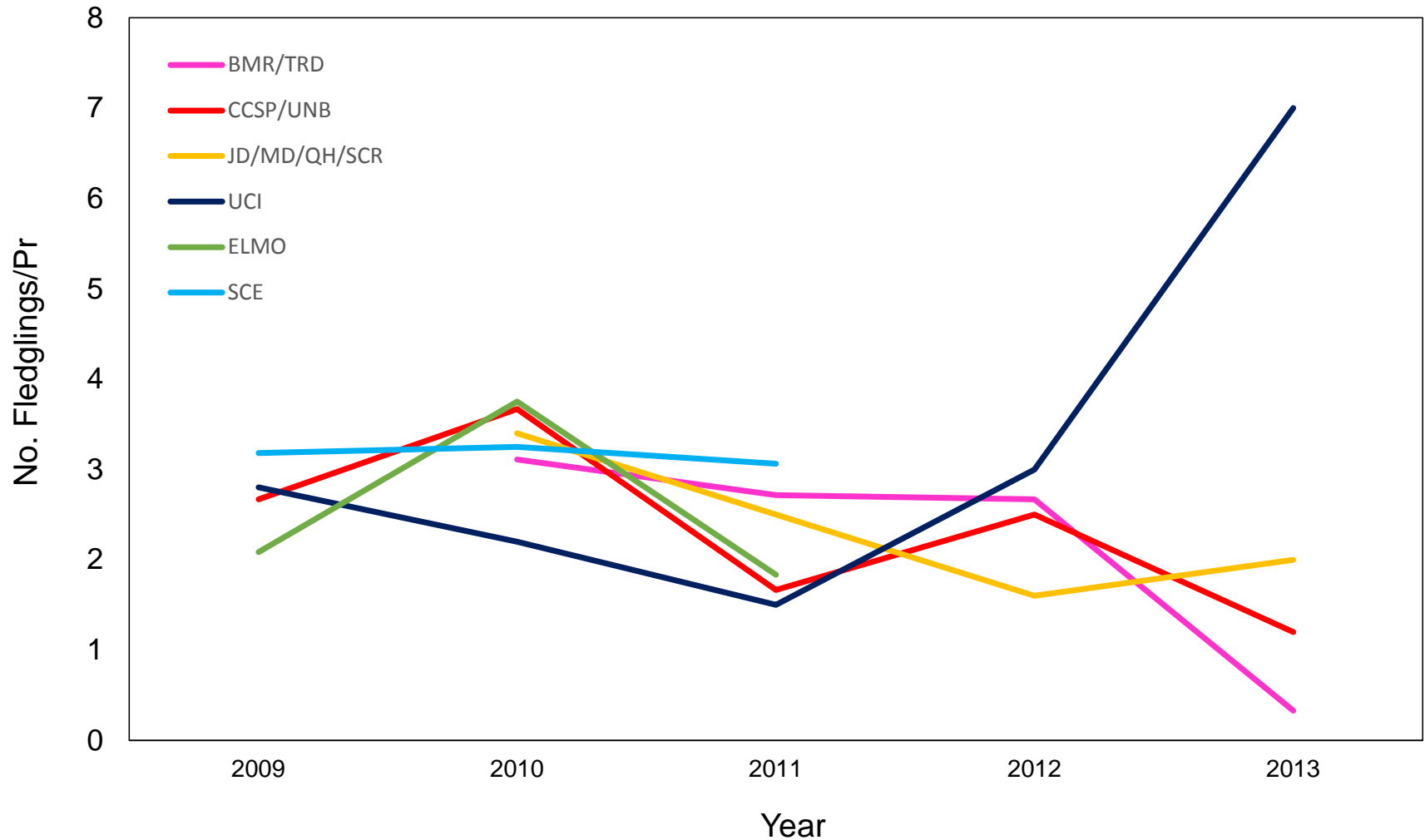
- *Population decline during recent droughts*
- *Role of predation unknown*



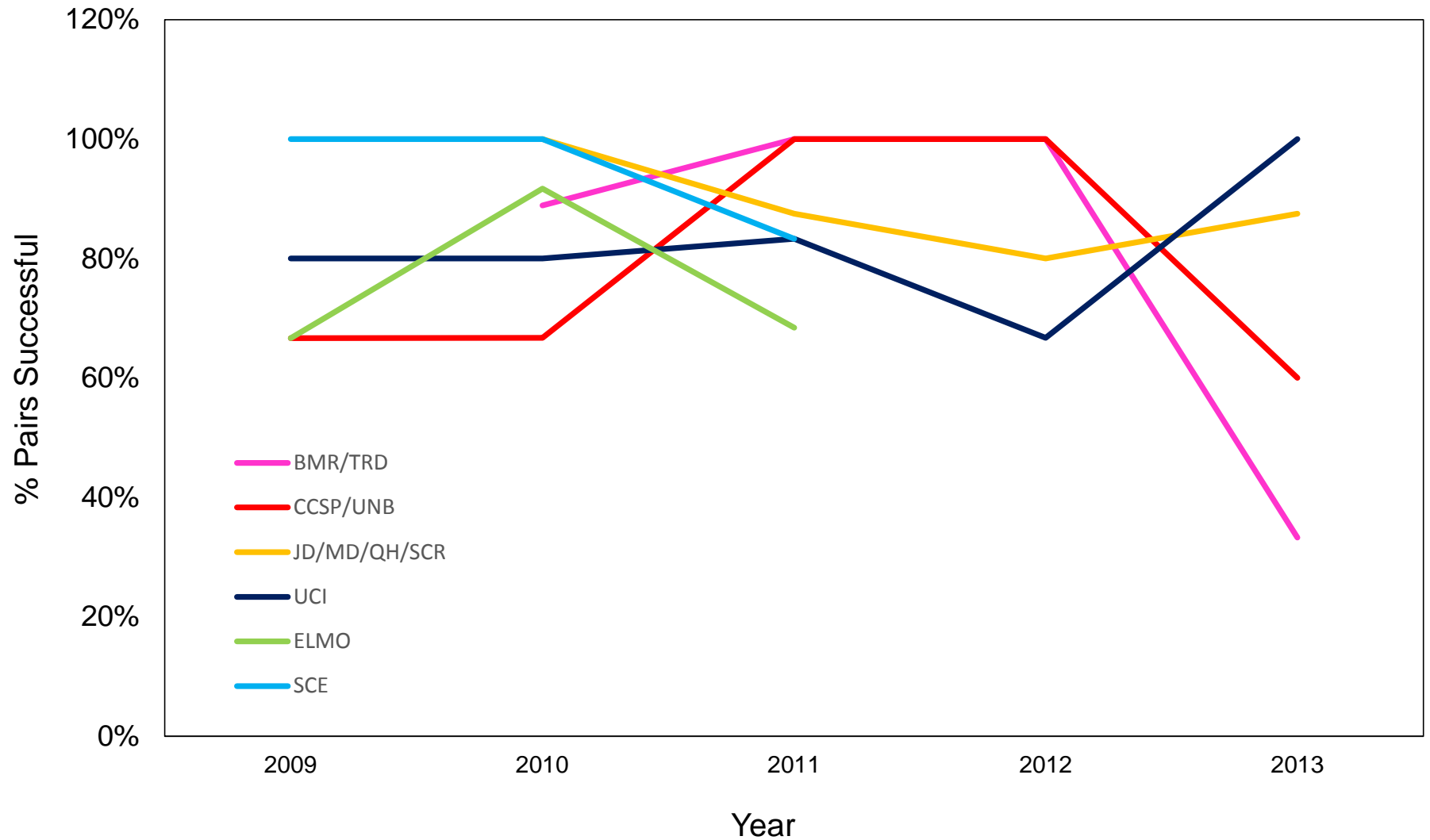
NROC Monitoring Study



Annual Productivity By Preserve Complex



% Pairs Produce Young By Site & Year



What Factors are Associated with Wren Productivity?

(Minimum # Fledglings/Pair/Year)

- *Density of Cactus Wren Pairs* – occupied, all cactus, # territories/site
- *Date of 1st Egg Lay*
- *Prop. of Visits Predators Detected* – all predators, corvids, Greater Roadrunners, Cooper's Hawks
- *Landscape Matrix* – % urban (1km), % coastal sage scrub (1km), % cactus (200m)
- *Nest Area Cactus*– % cactus (25m)
- *Precip*– bioyear, nesting season (Jan-Apr)
- *Average Min Temp*– pre-nest/egg lay (Jan-Feb), nestling (Apr) periods
- *Average Max Temp* – incubation (Mar-Apr), nestlings (Apr) periods
- *Topography* – elevation, topographic heterogeneity, northness, % slope
- *Normalized Difference in Vegetation Index (NDVI)*

Modeling Methods

- *ArcGIS - Moran's I test with residuals from multiple linear regression to assess spatial-temporal clustering*
- *Data are spatially & temporally correlated*
- *General Least Squares Regression – handles covariance between spatial & temporal variables*
- *Gaussian, exponential & spherical spatial correlation structures*
- *Compared alternative models compared - AIC_c, model weights & evidence ratios*

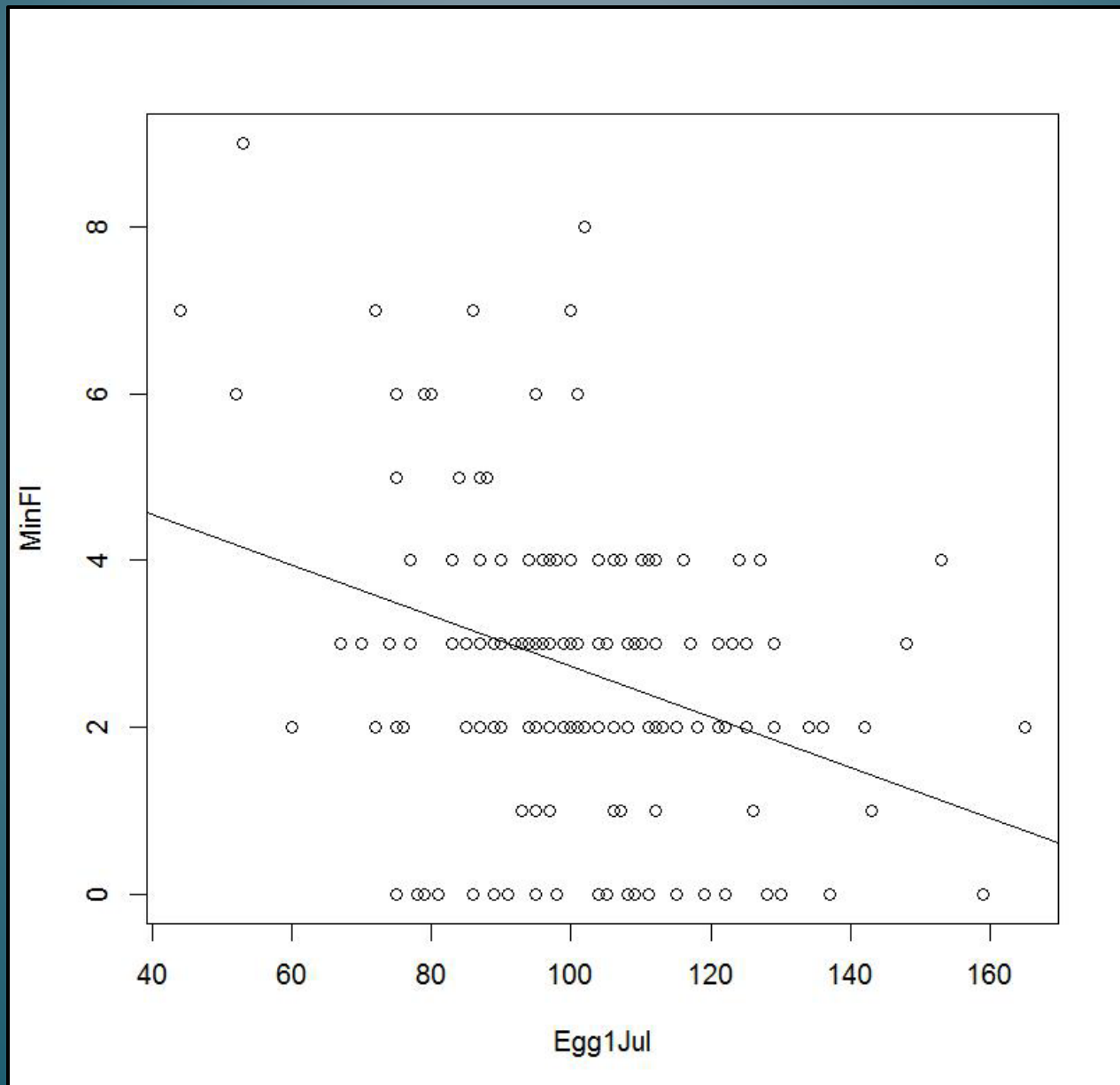


GSL Models Predicting Minimum # Fledglings/Pair/Year

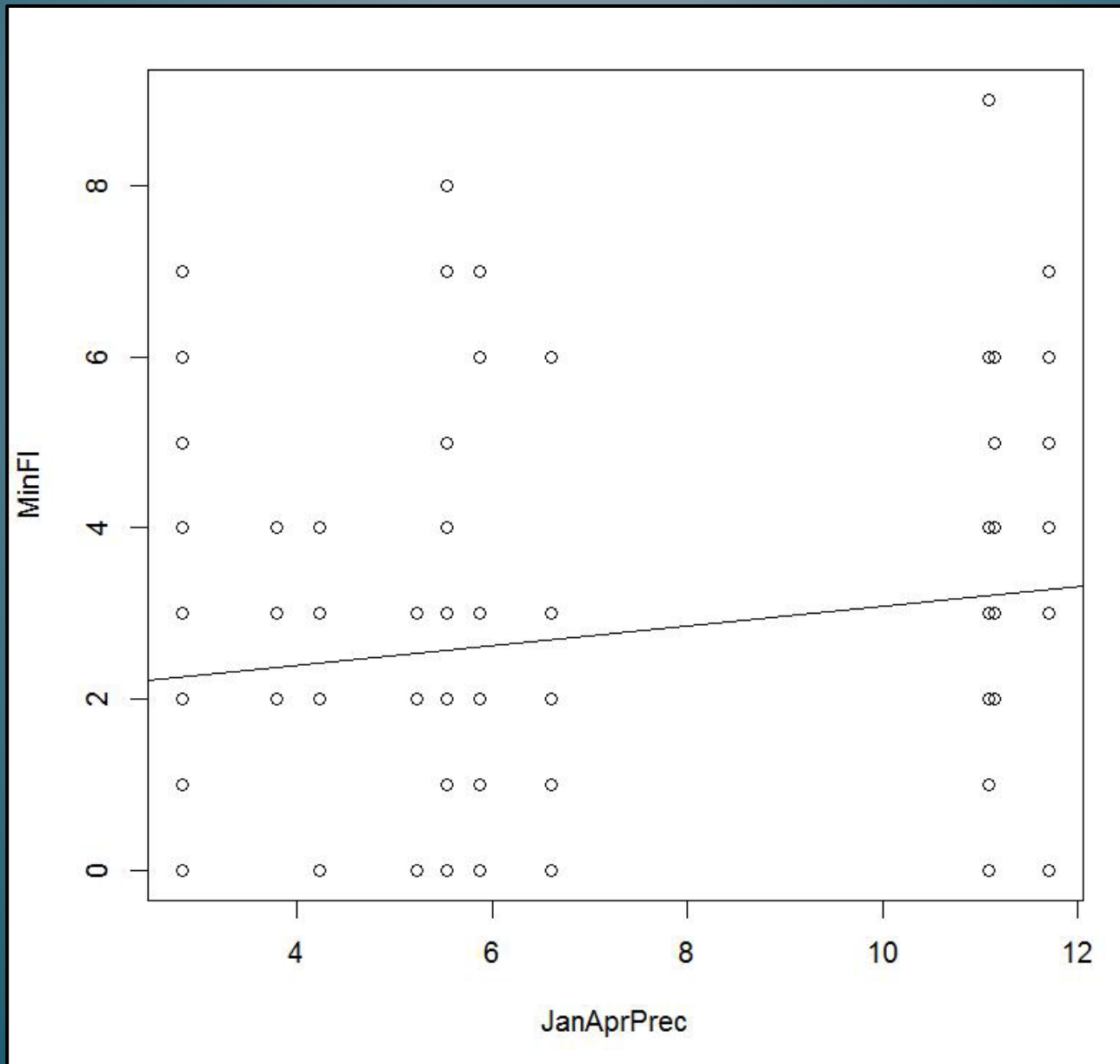
Models include Exponential Spatial-Temporal Correlation Structure

Model Parameters	K	Δ_i	ω_i	Evidence Ratio ω_i/ω_1
Year, Pair Density Occupied Cactus, PCorvids, Julian 1st Egg, Jan to Apr Precip, Min Jan & Feb Temp, Elevation, Topographical Heterogeneity, % Cactus 200m	11	0.0000	0.9980	
Year, Pair Density Occupied Cactus, Pcorvids, Julian 1st Egg, Jan to Apr Precip, Min Feb Temp, Max Mar & Apr Temp, Topographical Heterogeneity, Northness, % Urban 1km, % Cactus 200m	13	8.9990	0.0020	499.00
Year, # Territories, PCOHA, Julian 1st Egg, Jan to Apr Precip, Min Jan & Feb Temp, Max Mar & Apr Temp, Topographical Heterogeneity, Northness, % Slope, % Cactus 200m	13	13.1796	0.0004	2,495.25
Year, Pair Density Occupied Cactus, PCorvids, Julian 1st Egg, Jan to Apr Precip, Min Apr Temp, Max Apr Temp, Elevation, Topographic Heterogeneity, Northness, % CSS 1km, % Urban 1km, % Cactus 200m	15	21.4090	0.0000	24,952.50
Year, Pair Density All Cactus, PAll Predators, Julian 1st Egg, Biological Rainfall Yr, Min Jan & Feb Temp, Max Mar & Apr Temp, Elevation, Topographic Heterogeneity, Northness, % Slope, NDVI, % Cactus 25m	15	26.0594	0.0000	332,700.00

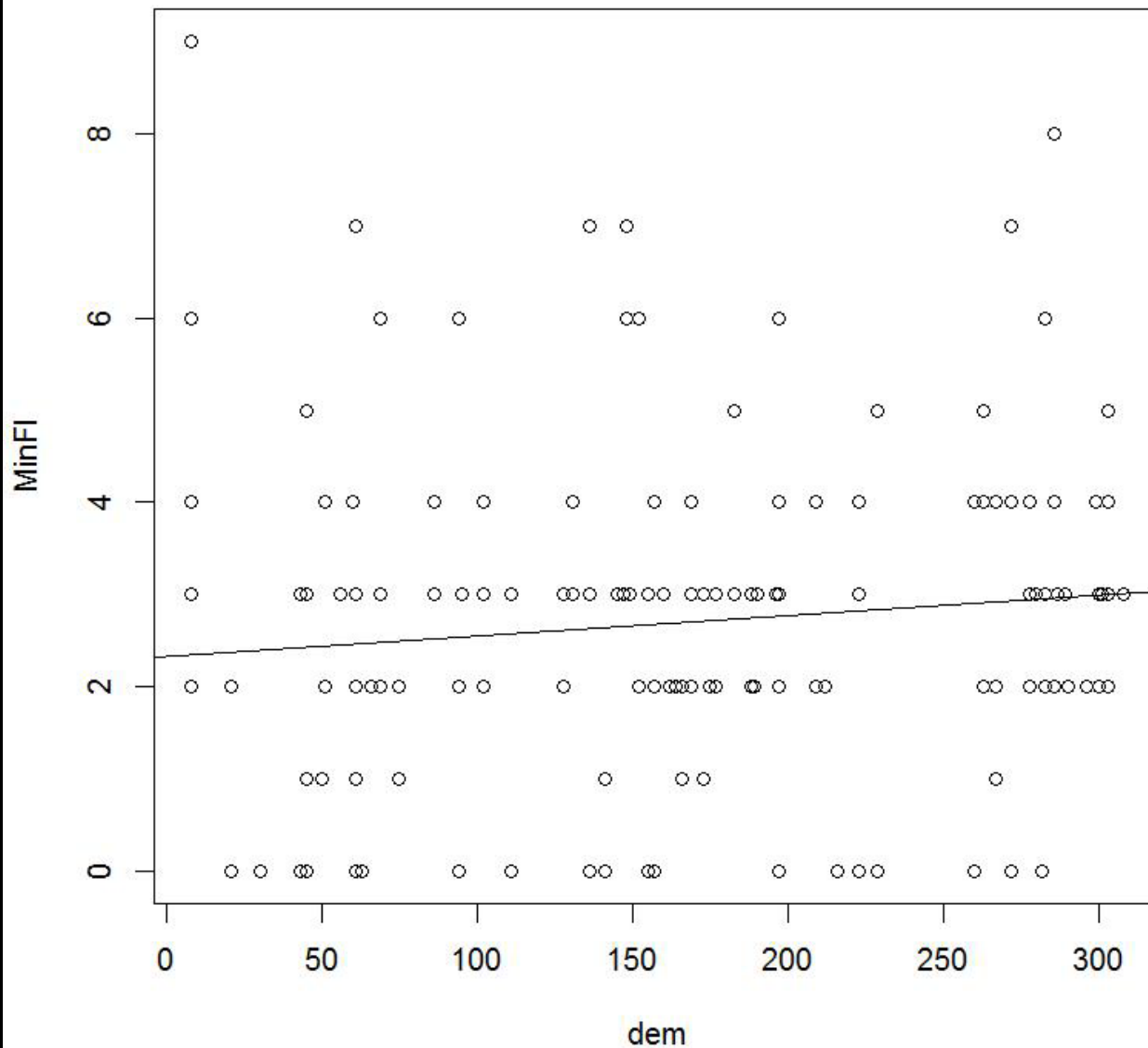
Minimum # Fledglings vs 1st Egg Lay Date



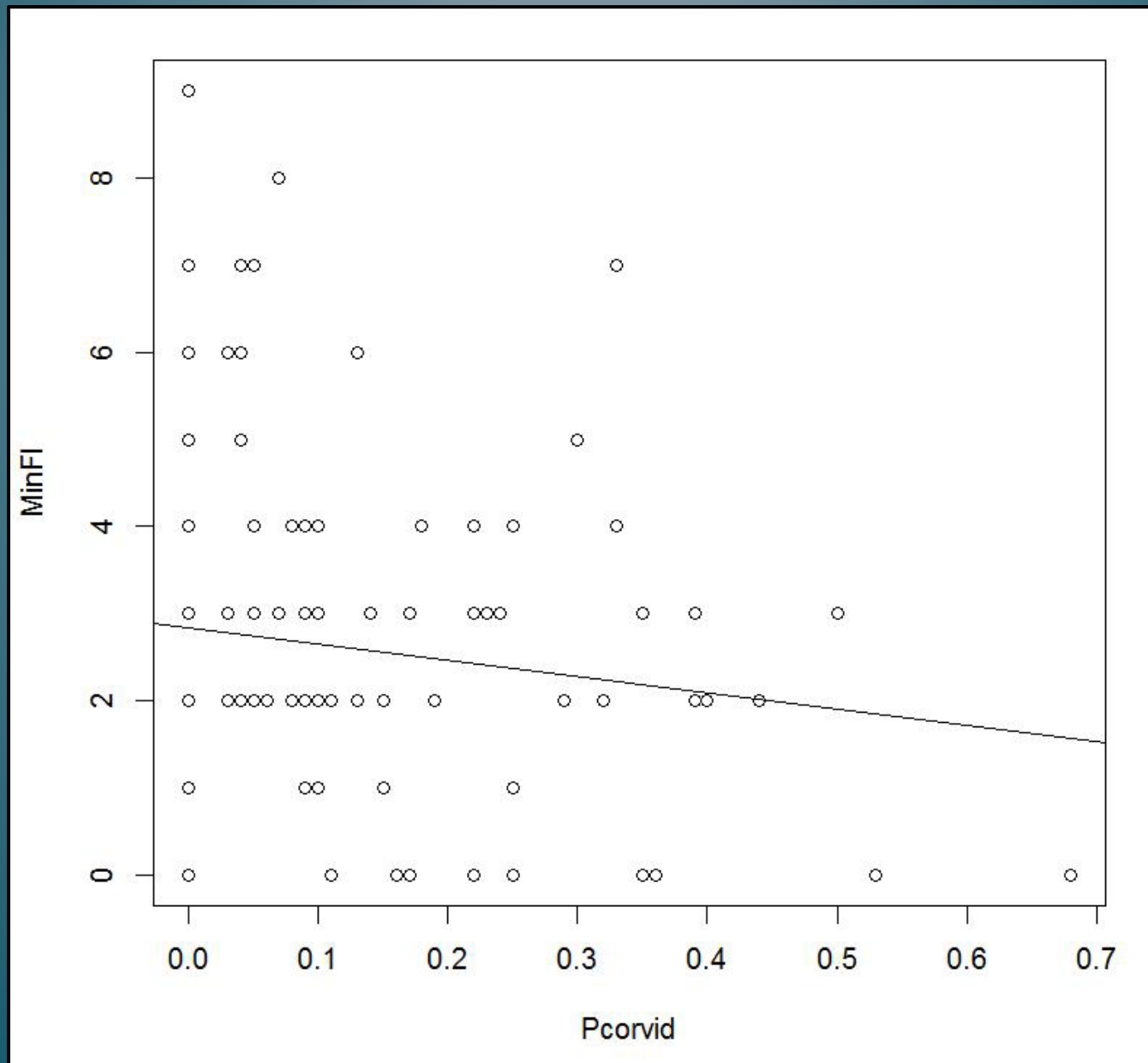
Minimum # Fledglings vs Jan to Apr Precip



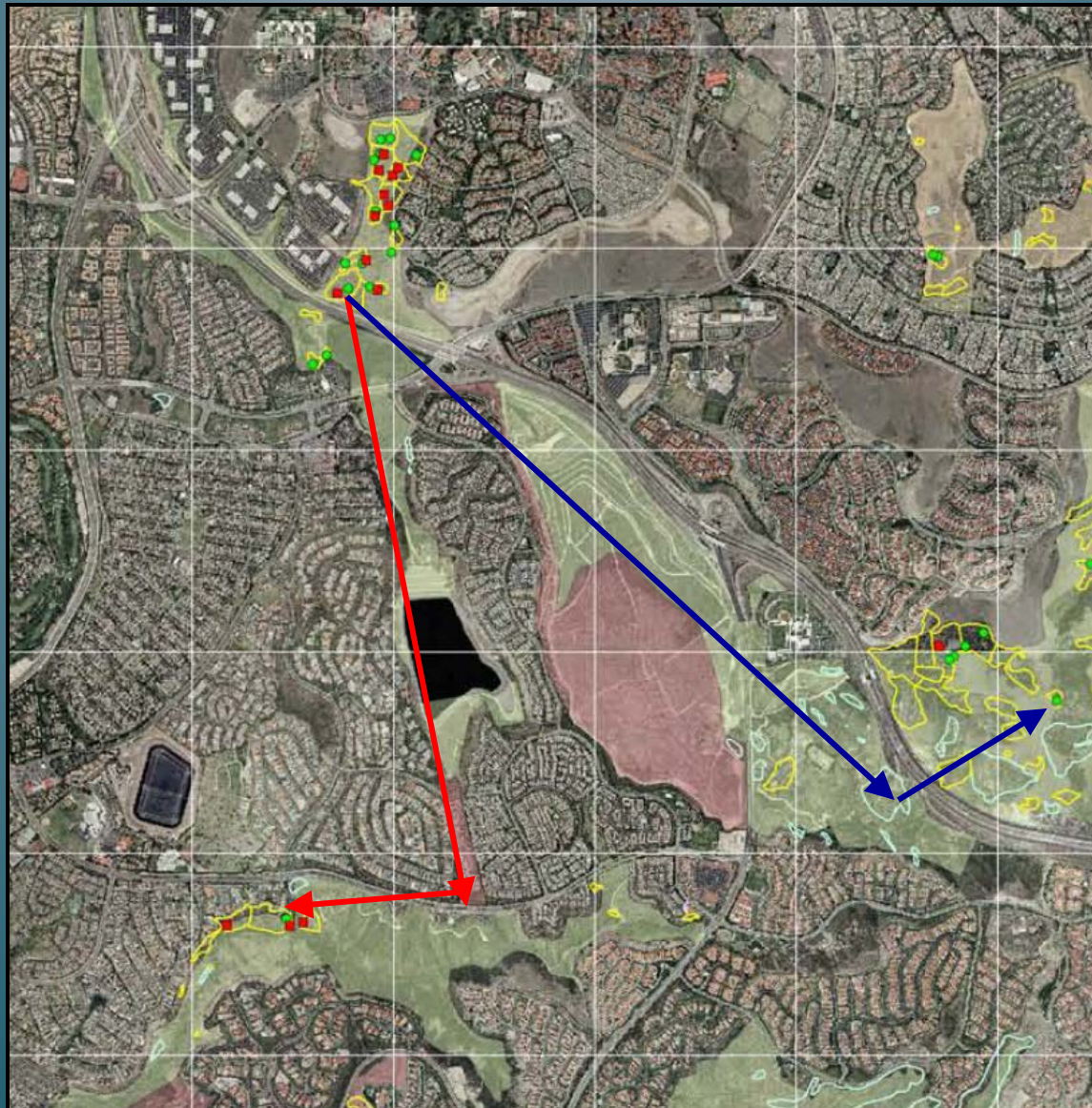
Minimum # Fledglings vs Elevation



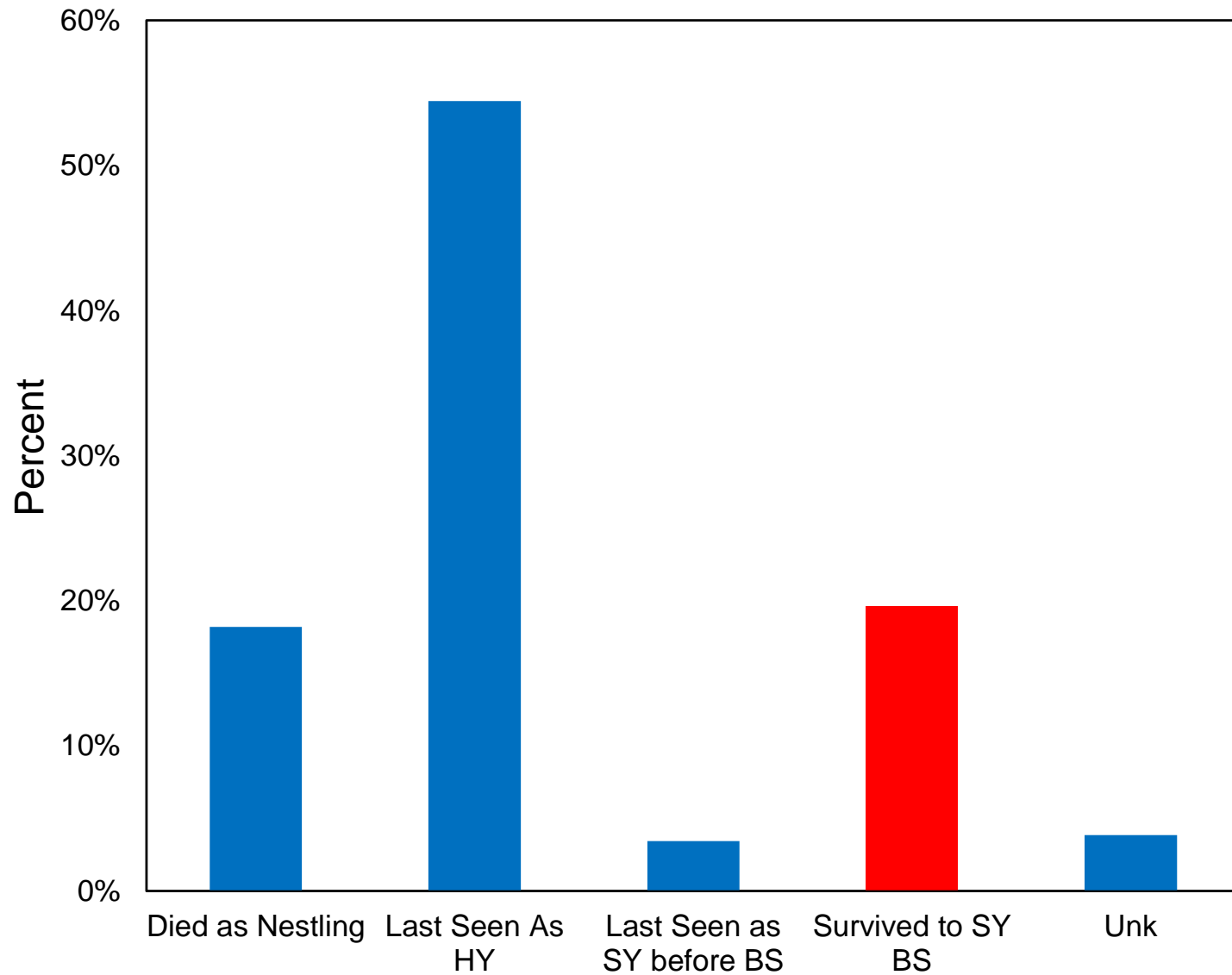
Minimum # Fledglings vs Proportion of Visits Corvids Detected



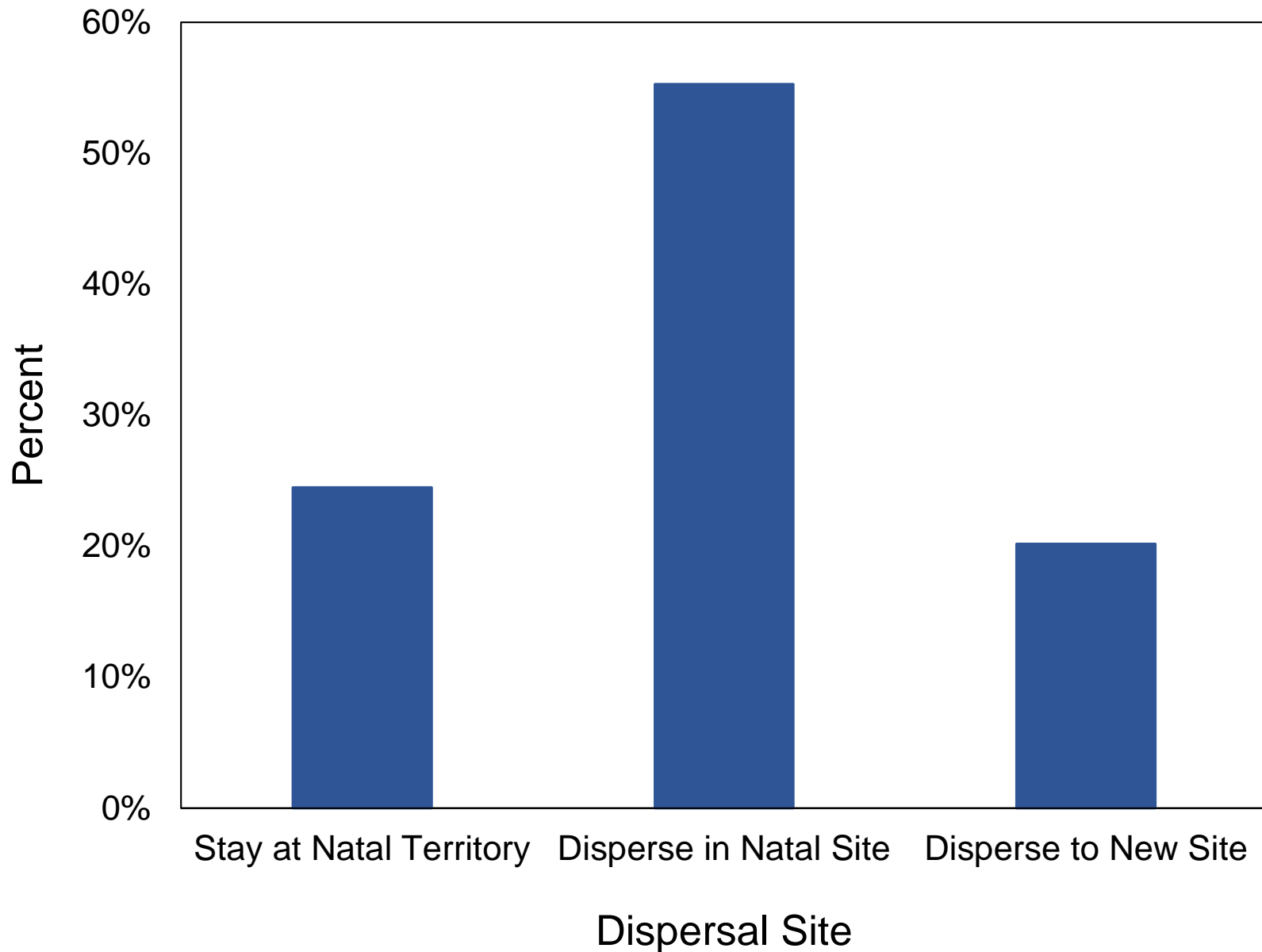
How Well are Young Surviving, Dispersing & Recruiting as Breeders?



Fate of 494 Wrens Banded as HYs



Where Do SY Wrens Disperse To?



How Many Banded Hys Get Territories & Mates?

- 18.2% of 97 Hys Surviving to next Breeding Season Obtained Territories
- 32% were “floaters” prior to getting territory
- 87.6% of surviving Hys eventually obtained a mate



Photo Karly Moore

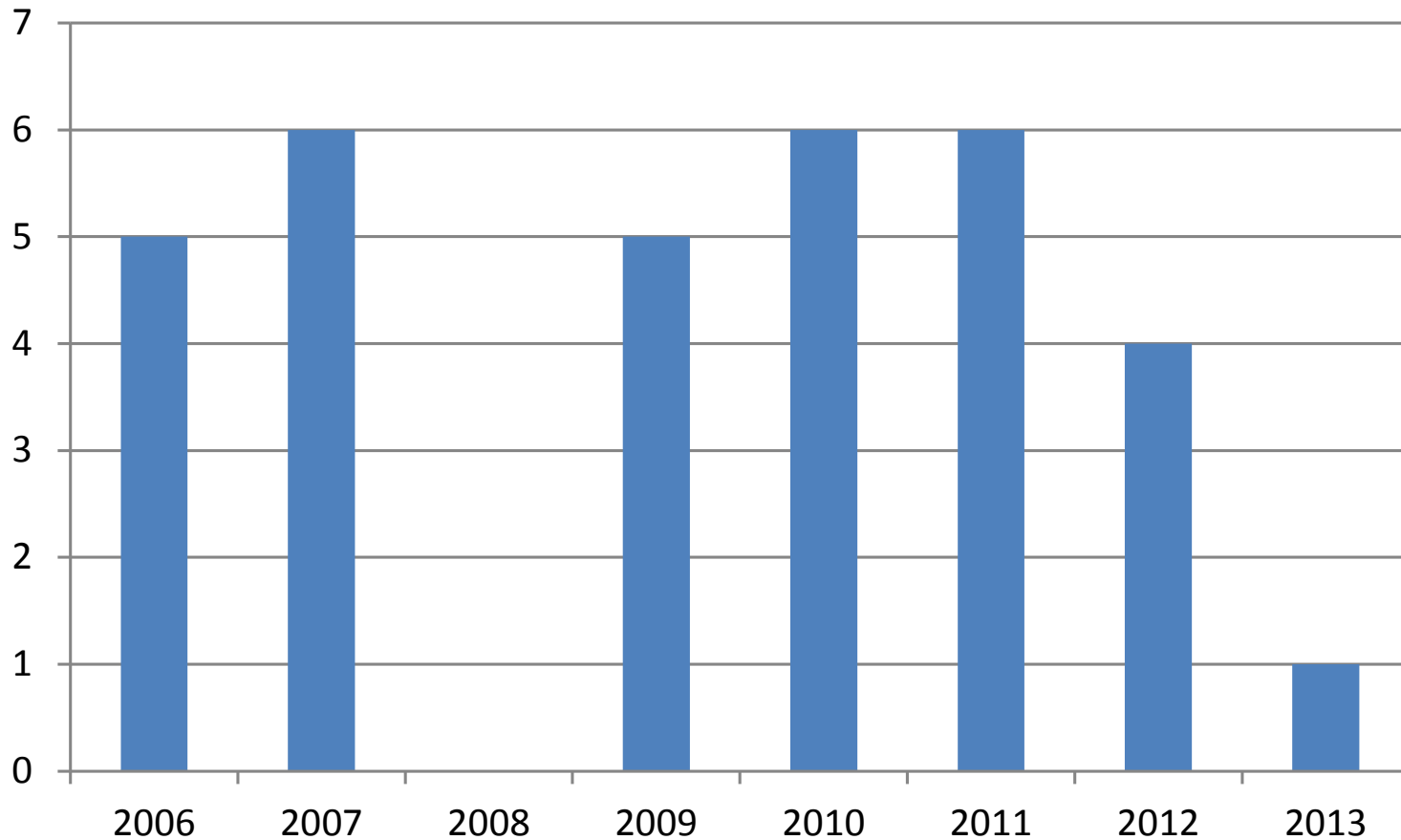
Adult Dispersal, Divorce & Death

- 68% of banded adults assumed died during study
- 12 cases of divorce among 94 banded adults
- 20 adults moved to new territory at same site as 1st (68% F)
- 7 adults moved to new territory at new site (50% F)



EXAMPLE OF SMALL POPULATION VULNERABILITY

Territories at UCI



Summary

- *Productivity is low & associated with time of egg laying, Jan-Apr rainfall, elevation & corvids*
- *Nest predation moderate, nestling survival (82%)*
- *Fledgling/juvenile survival very low, only 20% survive to next breeding season*
- *Predation of adults & young can be high, esp by COHA*
- *Food important in productivity (delayed nestling development) & positive effect of rainfall*
- *Habitat quality could be big problem for productivity & persistence (invasive annuals & shrub/vine overgrowth)*
- *Poor dispersers although some can move up to 10km or so*
- *Most young stay at natal site (has implications for genetics)*
- *Floater strategy to recruit into breeding population (could result in polygyny & helpers at nest)*

THANK YOU!



Photo Karly Moore