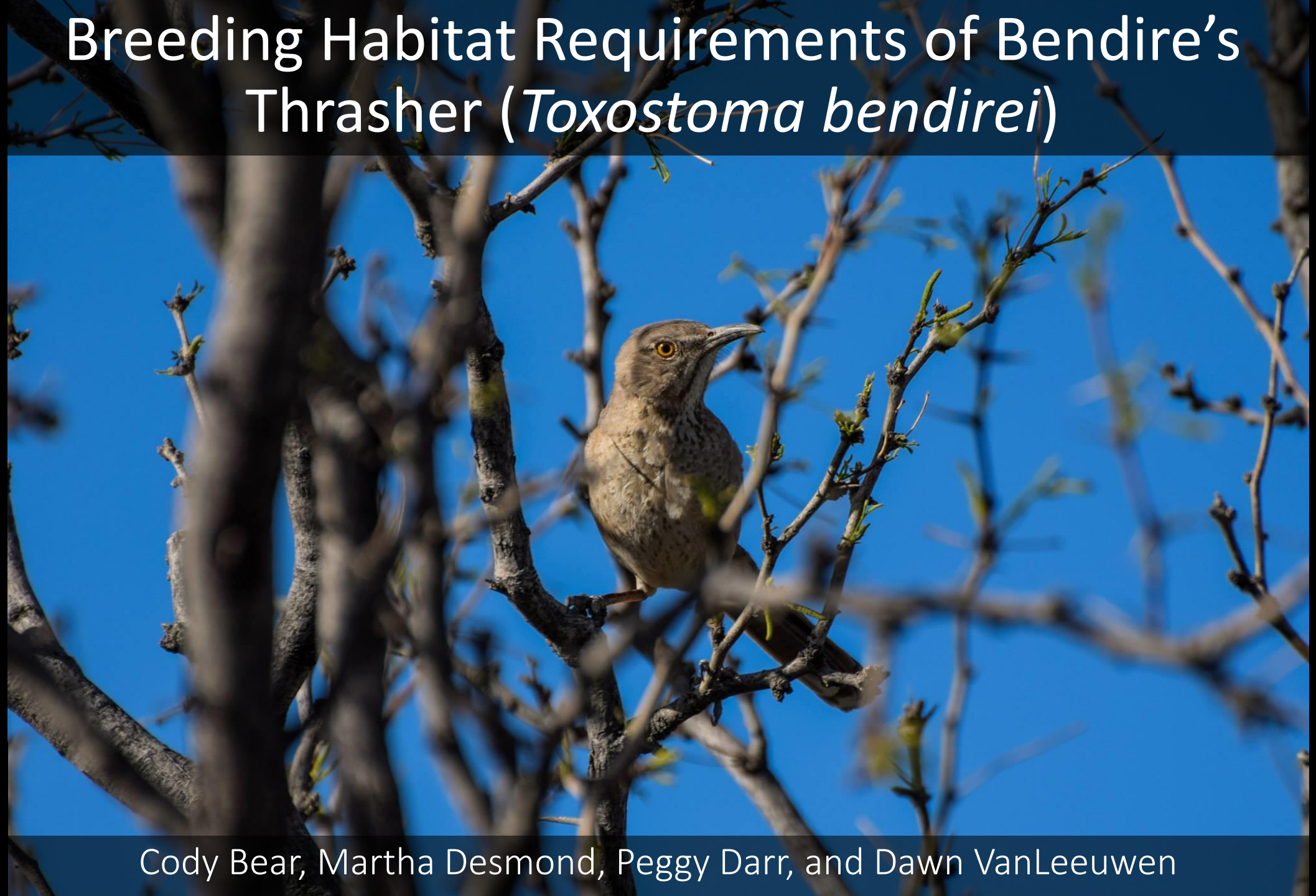
Breeding Habitat Requirements of Bendire's Thrasher (*Toxostoma bendirei*)



Cody Bear, Martha Desmond, Peggy Darr, and Dawn VanLeeuwen

Background

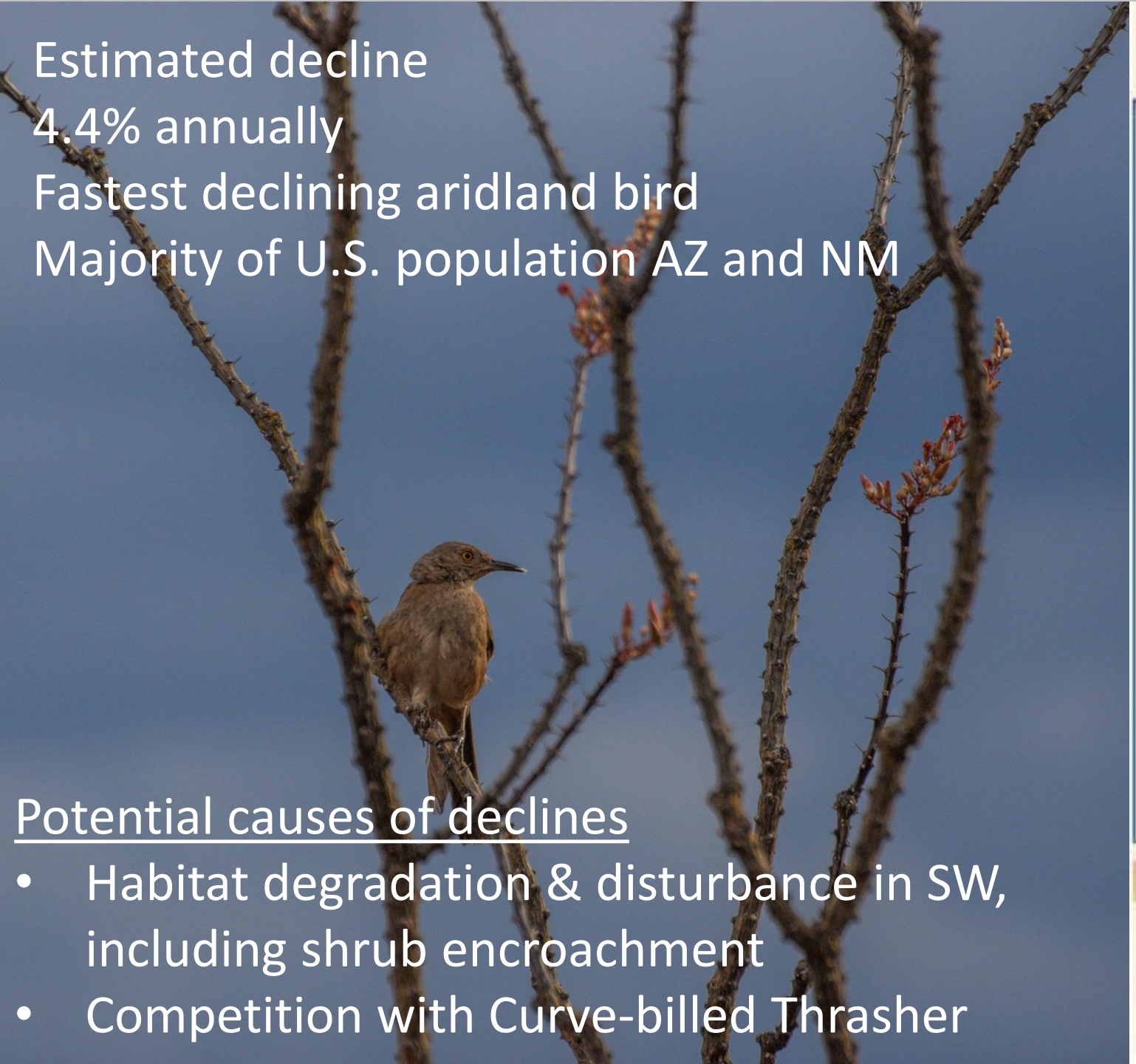
- Arid land birds are among fastest declining avian group in the U.S.

- Three of the fastest declining aridland species are aridland obligates
  - Bendire's Thrasher
  - Le Conte's Thrasher
  - Sage Thrasher

Sage Thrasher

Le Conte's Thrasher

Estimated decline
4.4% annually
Fastest declining aridland bird
Majority of U.S. population AZ and NM



<u>Potential causes of declines</u>

- Habitat degradation & disturbance in SW, including shrub encroachment
- Competition with Curve-billed Thrasher

BETH Objectives

1. Determine average BETH territory size & if varies by vegetation communities.

2. Examine differences in BETH habitat selection among vegetation communities.

3. Compare multiscale characteristics within and surrounding BETH territories with randomly selected sites.

Methods: Study Area

Study Area

Southwestern NM and southern AZ

Based on MaxEnt model of BETH distribution in NM & eBird locations during breeding season for AZ

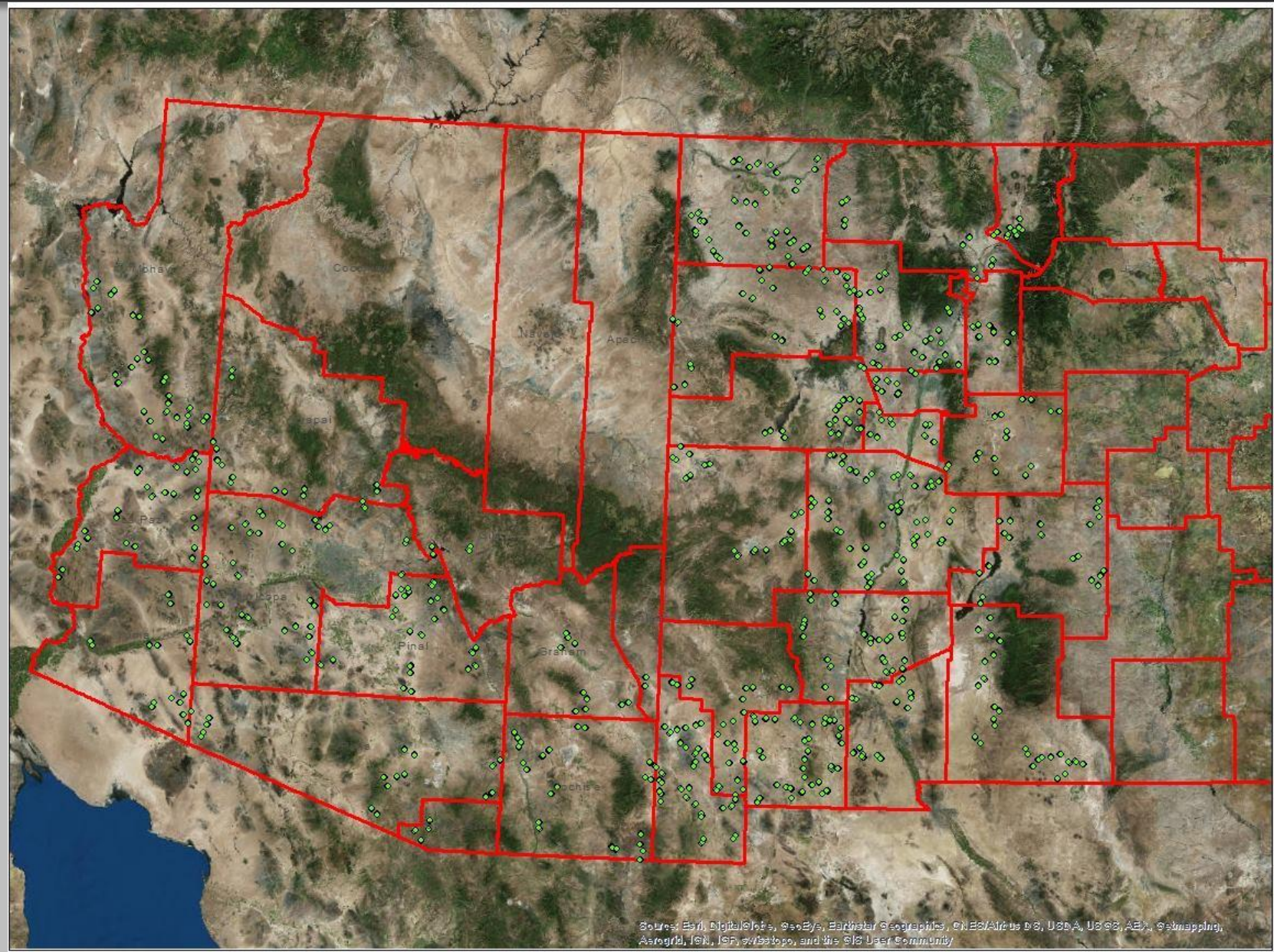
Stratify by vegetation type. Classifications will need to stay broad

- 1.) desert scrub, 2.) grassland, 3.) pinyon-juniper, and 4.) Sonoran-Paloverde.




Methods: BETH breeding surveys

- Used point counts & Area Search
  - NM: 2015 and 2016
  - AZ: 2016
- Mix of traditional point count and playback survey
- Survey length
  - 2015: 13.5 minutes
  - 2016: 7 minutes
- Modified area search around point counts

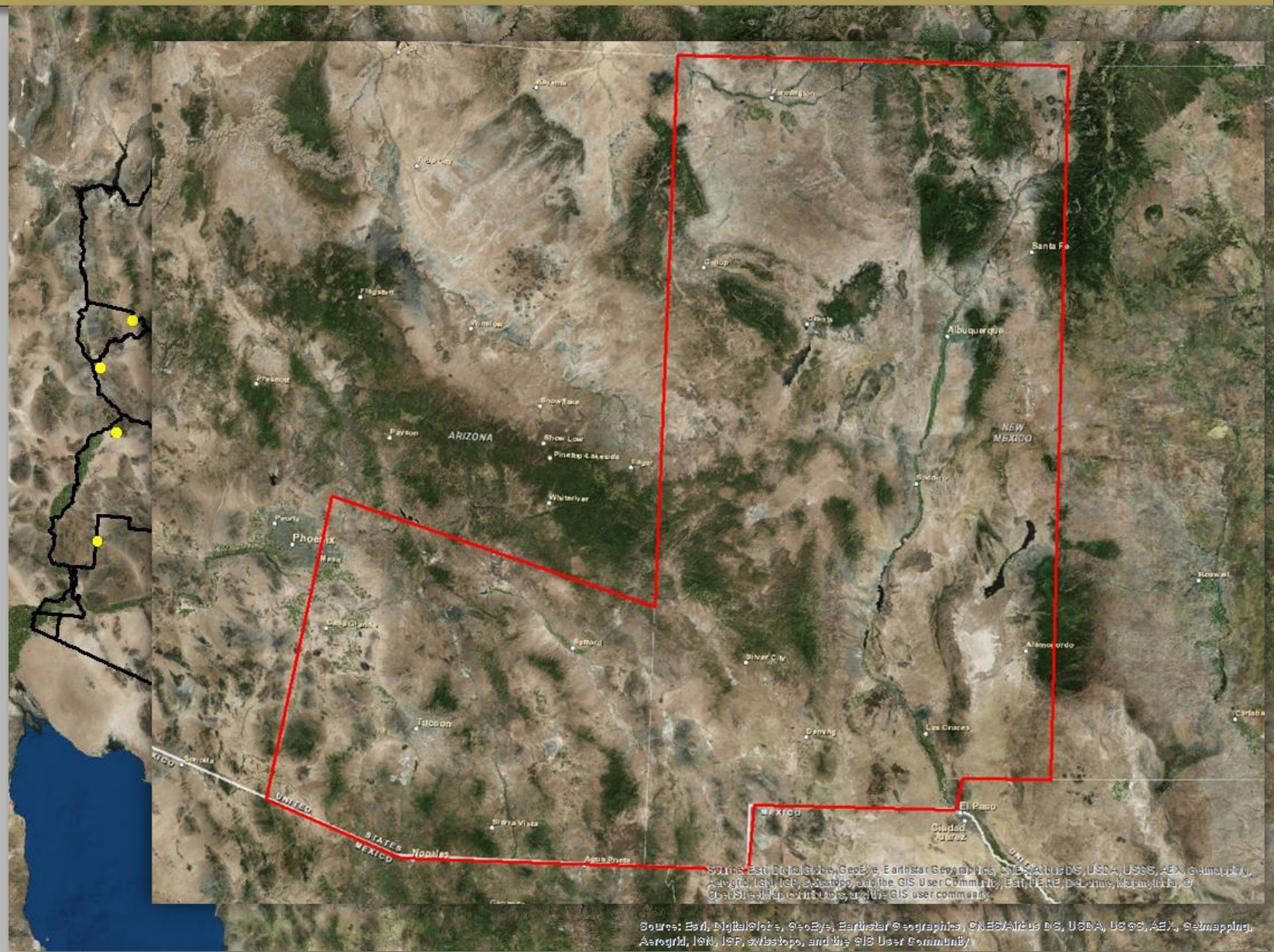


Methods: Breeding Territories

- Return to detection area
  - 4 days after initial detection
- Combination of spot-mapping and territory flush technique (Gregory et al. 2004 and Weins 1969) to map territories.
- GPS location of each perch
- Flushed BETH if needed
- Collected minimum of 20 locations

Methods: Territory Scale – Random Points

- We created random vegetation points for comparison
- Random vegetation points were the average size of the BETH territories
- 70 random sites plotted and surveyed in stratified vegetation communities throughout NM and AZ



Methods: Abiotic Scale

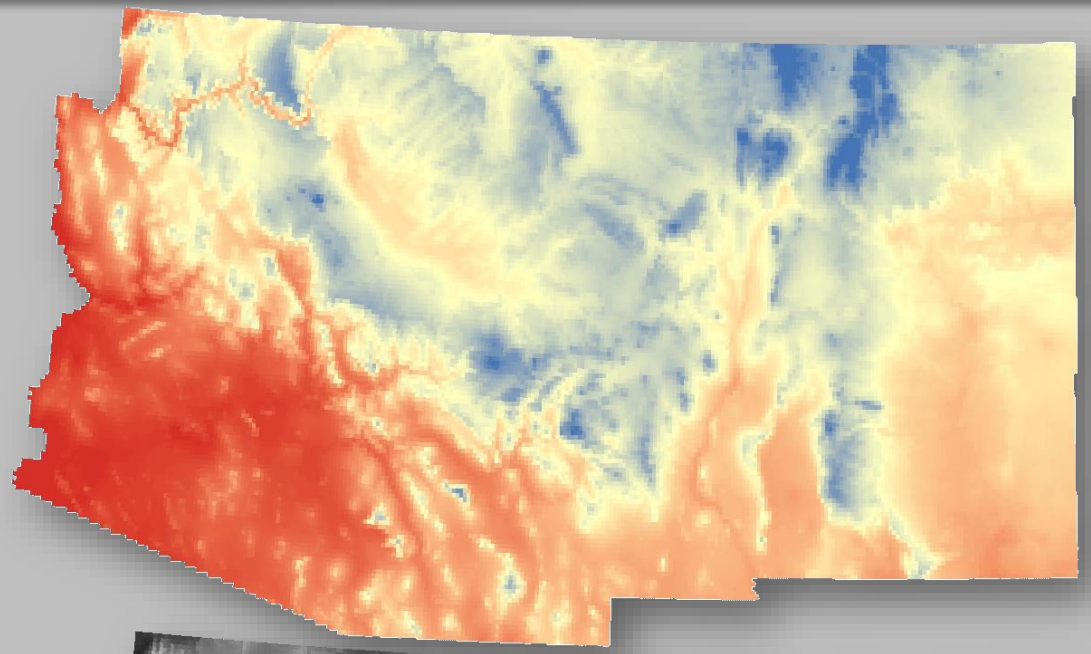
- Downloaded Rasters from OSU
- PRISM database (800m)

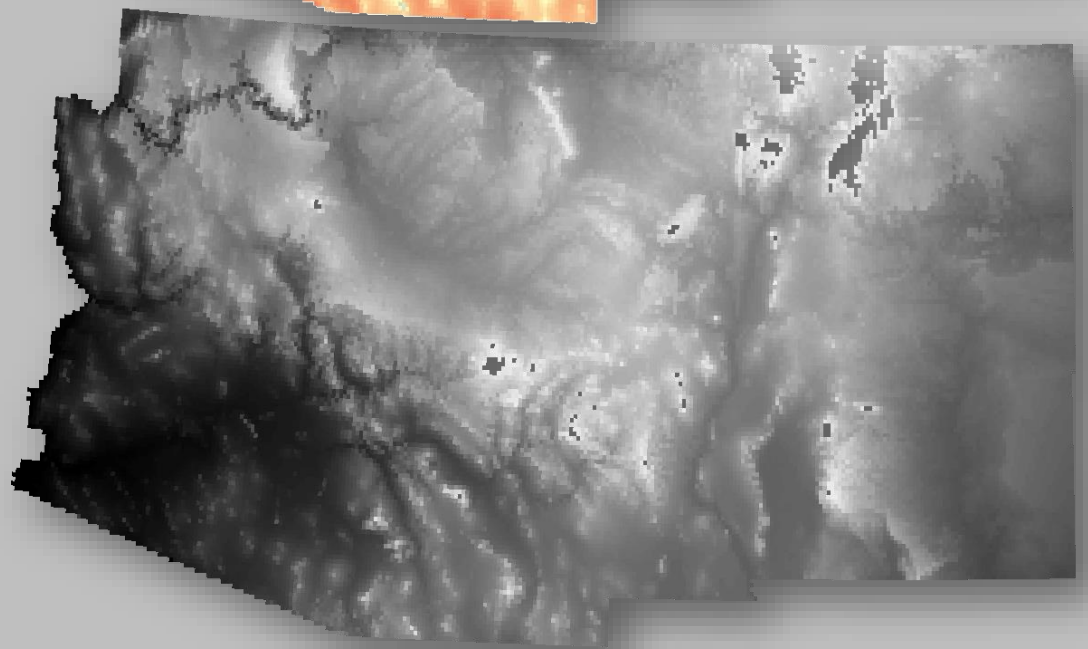
- SSURGO soil layer (100m)

- Topo data from NM RGIS and AZGEO database (10m)

Variables Produced:

- Year (YR)
- Elevation (ELV)
- Slope (SLP)
- Bioyear Precipitation (BYPT)
- Soil (SOIL)



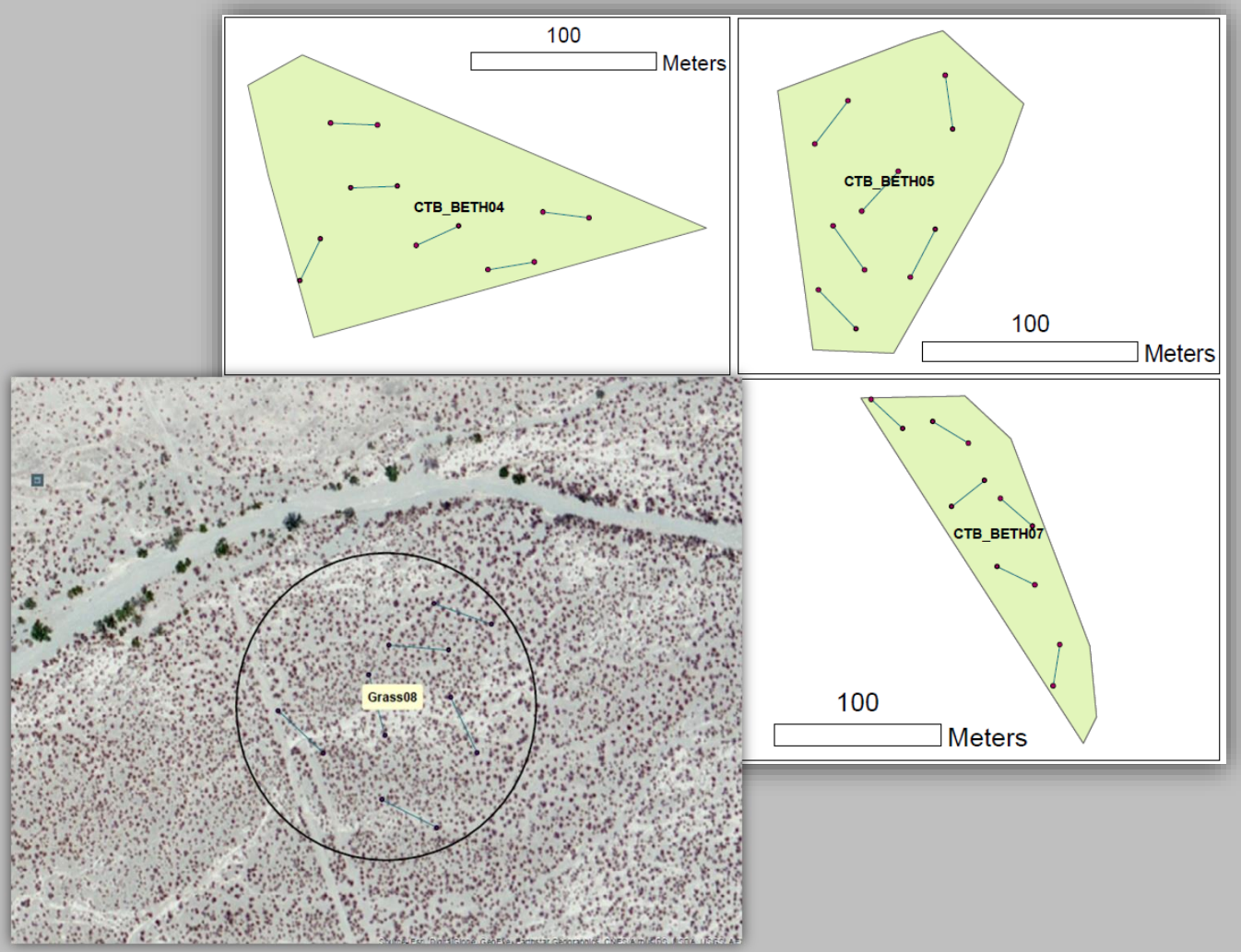


Methods: Territory Scale – Vegetation Collection

- Randomly plot six 25m transects within mapped territories using GIS.

Surveys:

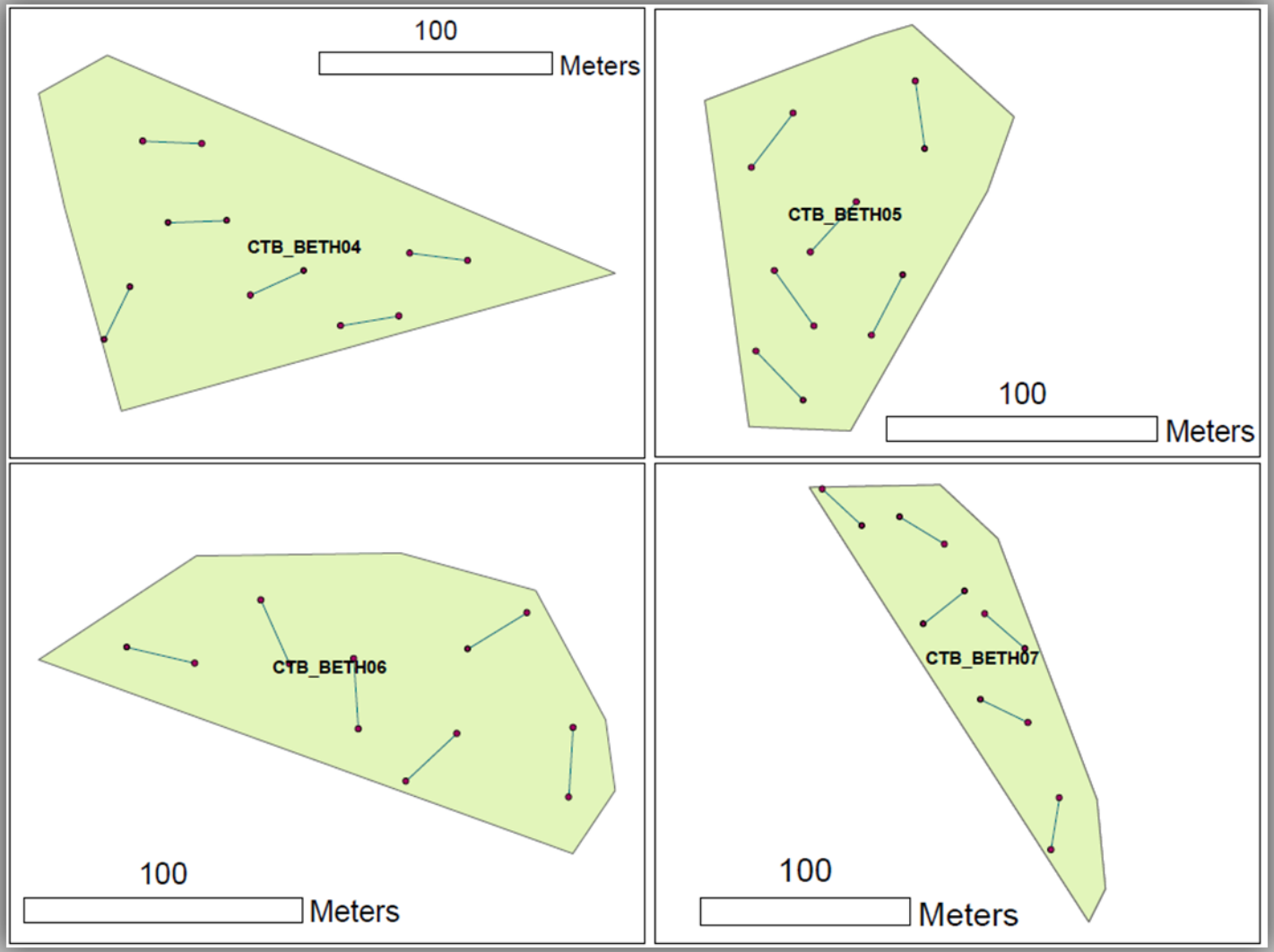
- Line intercept (species composition)
- Gap Intercept (bare ground)
- Belt Transect (Shrub density/height)
- Visual Obstruction
- Photo point



Methods: Territory Scale Selection

Variables Produced:

- Canopy gap 51-100 (CG1)
- Canopy gap >200 (CG2)
- Average Obstruction (AO)
- Shrub Density (PTD)
- Density of Tall Shrubs (PCD)
- Number of Tall Shrubs (NTS)
- Average Shrub Height (Shrubs over 1.5m) (ASH)
- Bare Ground (BG)



Methods: Landscape Scale

- Created 1000m (1km) buffer around Territory and Random Sites
- Hand digitized habitat within the buffer
- Categorized into same broad vegetation types from point counts
- Added Residential, Agriculture, Creosote.
- Used Patch Analyst in GIS to develop variables.

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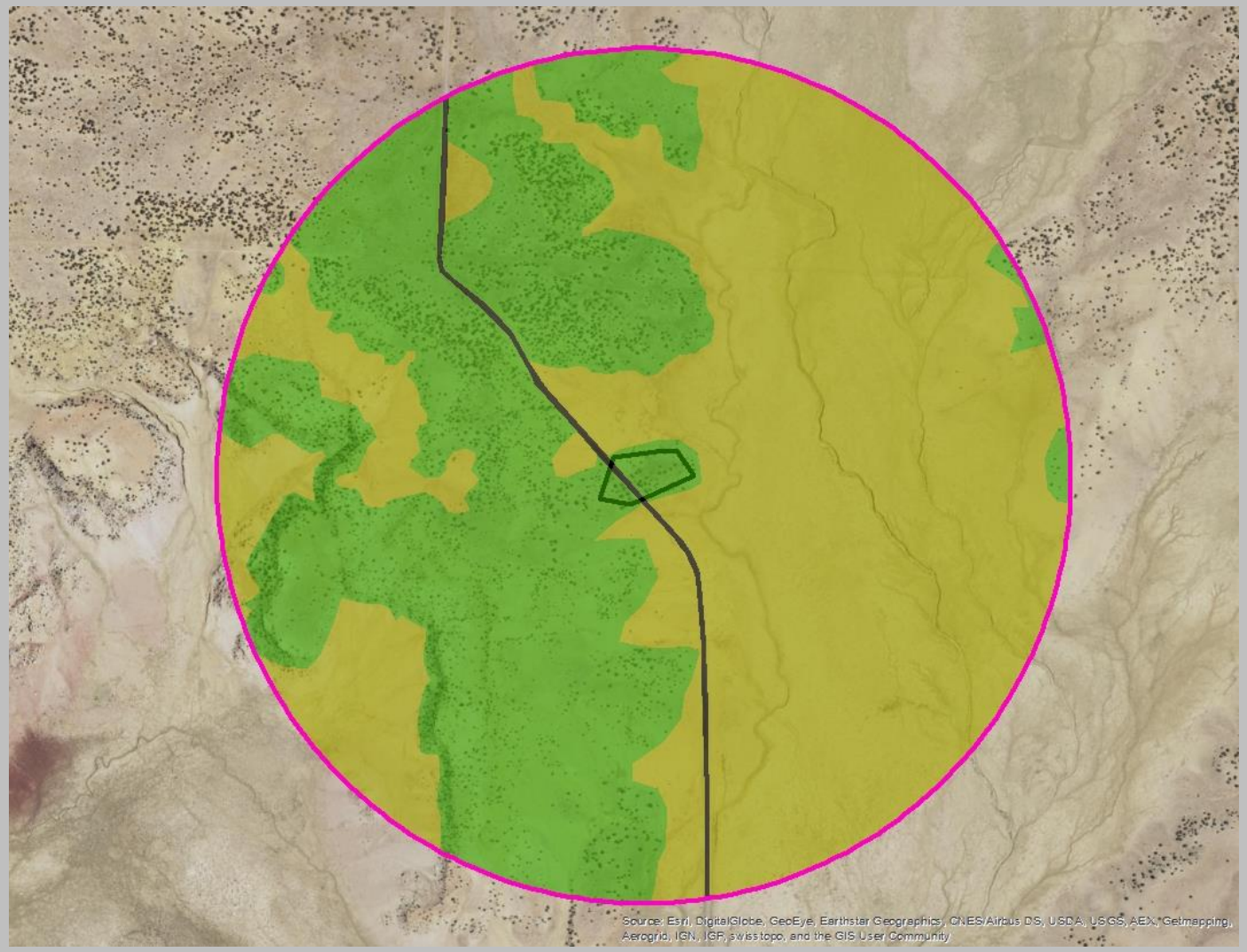
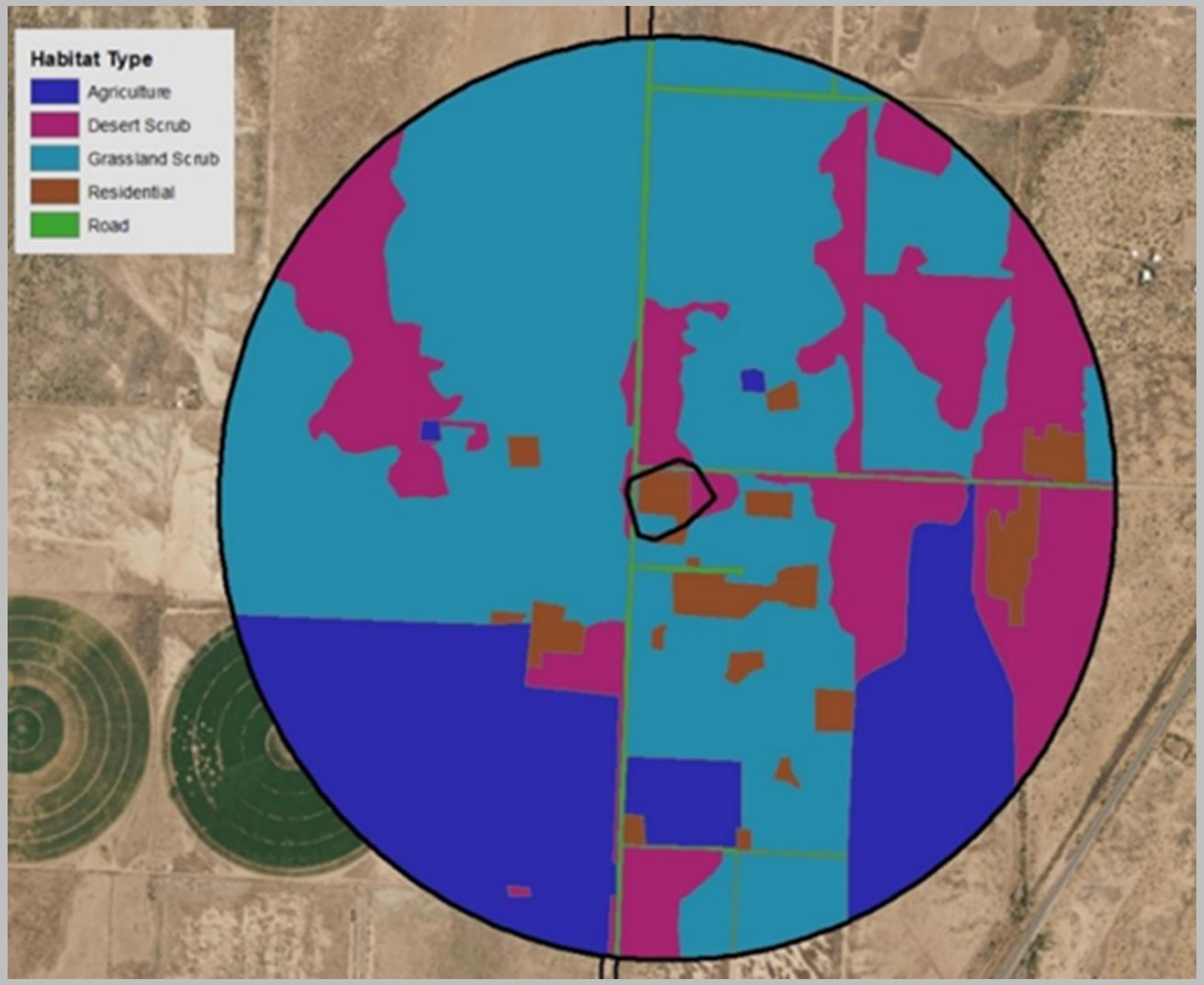


Methods: Landscape Scale

Variables Produced:

- Mean Patch Size (MPS)
- Mean Perimeter-Area Ratio (MPAR)
- Mean Fractal Dimension (MFD)
- Richness (RIC)
- Dominance (DOM)
- Edge Density (ED)



Analysis: Territory Size

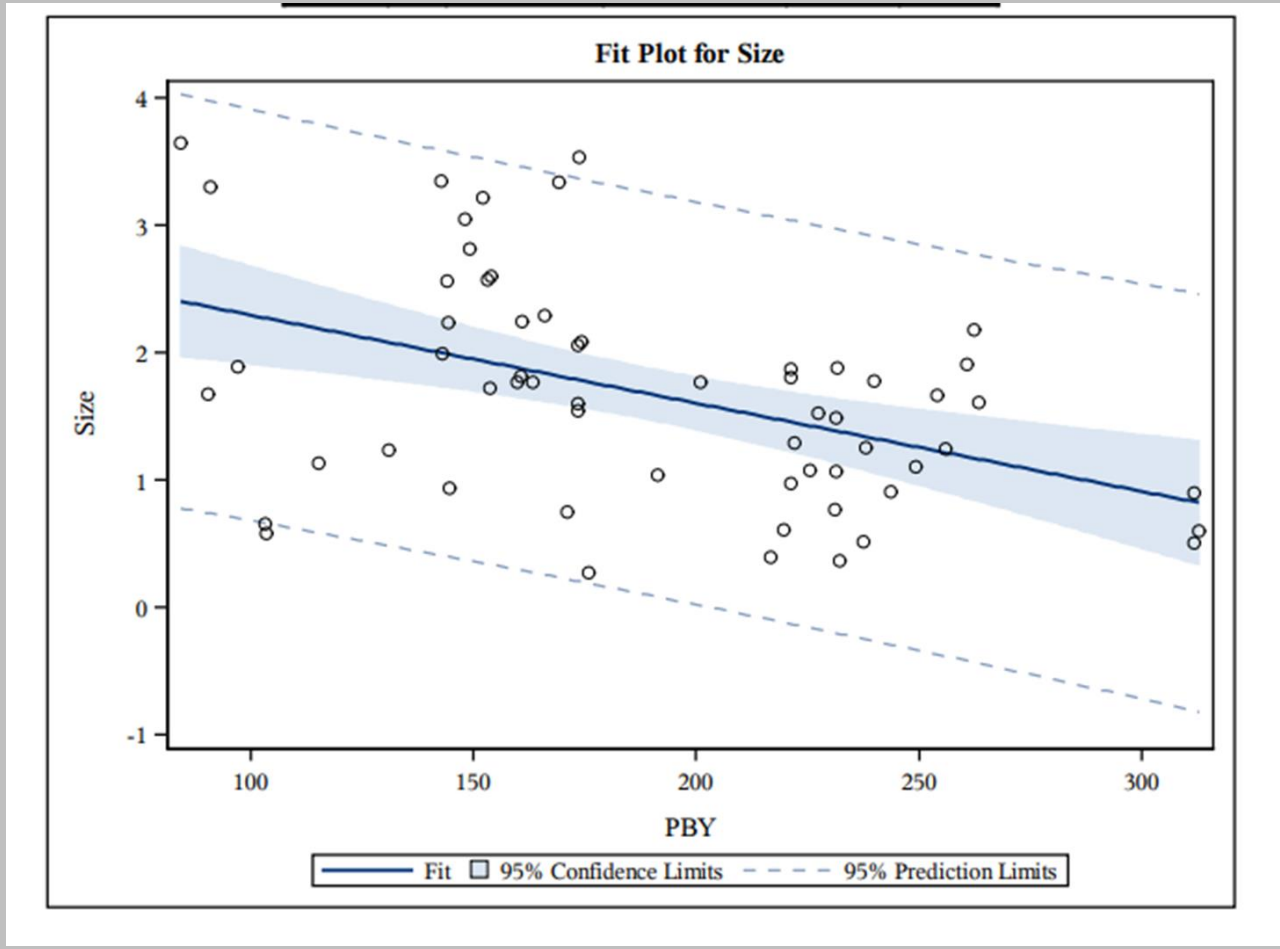
- Minimum Convex Polygons in GIS
- Generated Areas in Hectares
- Compared territory size among four vegetation types.

Results: Territory Size

Vegetation Type	N	Mean Size (Ha)	Std Dev	Minimum	Maximum
Scrub	11	**1.29**	0.86	0.50	3.22
Grassland	26	**1.87**	0.81	0.51	3.54
Pinyon-Juniper	12	**1.63**	0.82	0.27	2.81
Sonoran-Paloverde	11	**1.62**	1.03	0.39	3.65

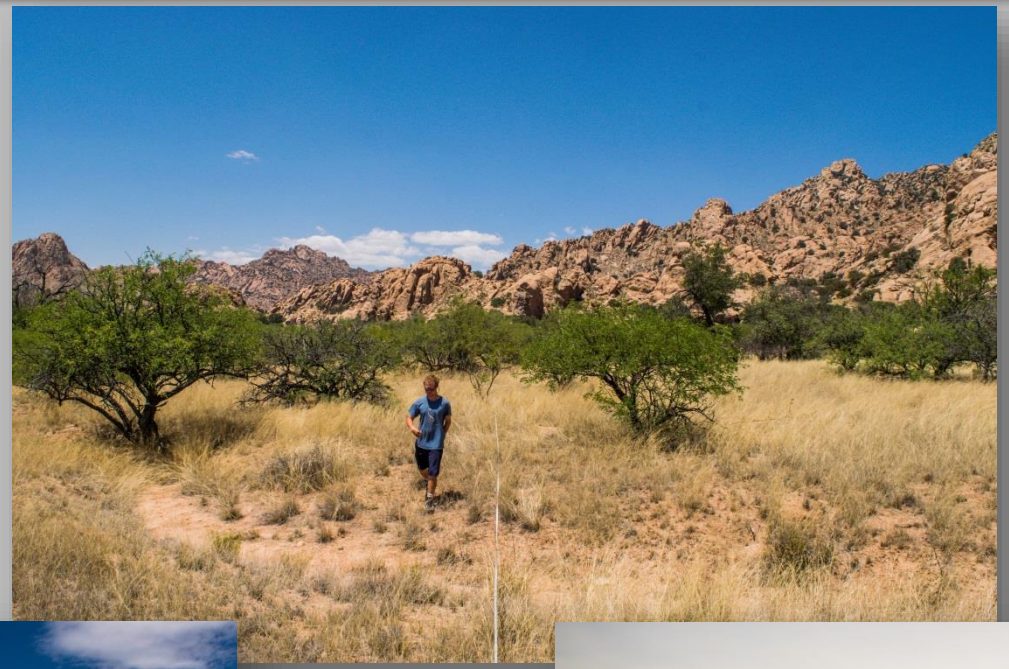
Year	N	Mean	Std Dev	Minimum	Maximum
2015_NM	25	**1.28**	0.60	0.27	2.60
2016_NM	18	**2.29**	0.87	0.58	3.54
2016_AZ	17	**1.59**	0.87	0.39	3.65

- Territory size varied sig between yrs. $F_{2, 52} = 9.90$, $P = 0.0002$ (NM)
- Did not vary among vegetation types $F_{3,52} = 2.53$, $P = 0.1931$.



Analysis: Territory Differences Among Vegetation Types

- Compared differences in variables among 4 main vegetation types.
- Analyzed with ANOVAs in SAS with PROC GLM.



<u>Varied among Veg type</u>

- Slope
- Elevation
- VOR
- Bare G.
- Shrub Height
- Canopy Gaps
- Patch Richness
- Edge Density

Analysis: Multiscale Habitat Selection

Abiotic Scale

ELV (Elevation)
SLP (Slope)
PBY (Precipitation Bioyear)
YEAR

Territory Scale

AO (Average Obstruction)
NTS (Number of Tall Shrubs)
ASH (Average Shrub Height)
BG (Bare Ground)
PTD (Total Plot Density- shrubs)
CG2 (Canopy Gaps >200)
ASH*NTS
BG*PTD

Landscape Scale

MPS (Mean Patch Size)
MFD (Mean Fractal Dimension)
RIC (Richness)
DOM (Dominance)
ED (Edge Density)

Conditional logistic regression examining occupied territories with random locations across vegetation types using a priori models and an AIC_c approach

Results: Abiotic Scale

Model	-2 Log-likelihood	K[a]	ΔAIC	w_i
Year, Slope, Elevation	143.01	3	0	0.46
Elevation, Slope	146.23	2	1.22	0.25
Year, Slope, Elevation, Bioyear Precip	142.79	4	1.78	0.19
Elevation, Slope, Bioyear Precip	146.22	3	3.21	0.09

Results: Abiotic Scale

- Slope and elevation had the strongest influence on territory selection

- Selection decreased by:
  - ~7% with each 5% increase in the slope (odds ratio = 0.93)

  - ~9% with every 100m increase in elevation

Variable	β	95% CI		Scaled Odds Ratio
Slope (SL)	-0.016	-0.022 to	-0.045	0.927
Elevation (EL)	-0.002	-0.003 to	-0.002	0.905
Bioyear Precipitation (PB)	-0.001	-0.005 to	0.002	0.990
Year (YR)	-0.628	-0.944 to	-0.312	0.880

Results: Territory Scale

Model	-2 Log-likelihood	K[a]	ΔAIC	w_i
Average Obstruction, % Bare Ground, Average Shrub Height	145.85	3	0	0.37
Average Obstruction, % Bare Ground, Average Shrub Height, Number of Tall Shrubs	144.38	4	0.53	0.28
Average Obstruction, % Bare Ground, Average Shrub Height, Canopy Gaps >200cm	145.2	4	1.36	0.19
Average Obstruction, % Bare Ground, Average Shrub Height, Number of Tall Shrubs, Canopy Gap >200cm, Shrub Density	143.04	6	3.19	0.07

Results: Territory Scale

- Selection increased by:
  - 37% with each 10% increase in average obstruction (odds ratio = 1.37)
  - ~90% with each 10% increase in bare ground (odds ratio = 1.90)
  - 257% with each 1m increase in average shrub height (odds ratio = 3.57)
  - ~2% with each additional shrub above 1.5 m tall (odds ratio = 1.02).

Variable	β	95% CI		Scaled Odds Ratio
Average Obstruction (AO)	0.031	0.015 to	0.047	1.370
Bare Ground (BG)	0.070	0.040 to	0.099	1.895
Average Shrub Height (SH)	1.319	0.916 to	1.520	3.567
Number of Tall Shrubs (TS)	0.061	0.032 to	0.091	1.019
Canopy Gap (CG2)	-0.004	-0.013 to	0.005	0.923

Results: Landscape Scale

Model	-2 Log-likelihood	K[a]	ΔAIC	w_i
Mean Patch Size, Richness, Edge Density	152.88	3	0	0.6
Mean Patch Size	160.05	1	3.17	0.12

Results: Landscape Scale

- Mean patch size was the most important variable based on odds ratios
  - ~77% decrease in use with each 1 ha increase in the mean patch size (odds ratio = 0.23)

- Patch richness increased the odds of use by 58% with each additional vegetation community type within 1 km of a territory (odds ratio = 1.58)

Variable	β	95% CI	Scaled Odds Ratio
Mean Patch Size (PS)	-2.011	-2.821 to -1.202	0.229
Richness (RI)	0.342	0.088 to 0.596	1.580
Edge Density (ED)	-3.11E-07	-7.56E-07 to 1.33E-07	1.000

Discussion

- Average territory size similar to that of other N.A. Thrashers.
- d
- Avoidance of uninterrupted brushy cover and continuous grasslands

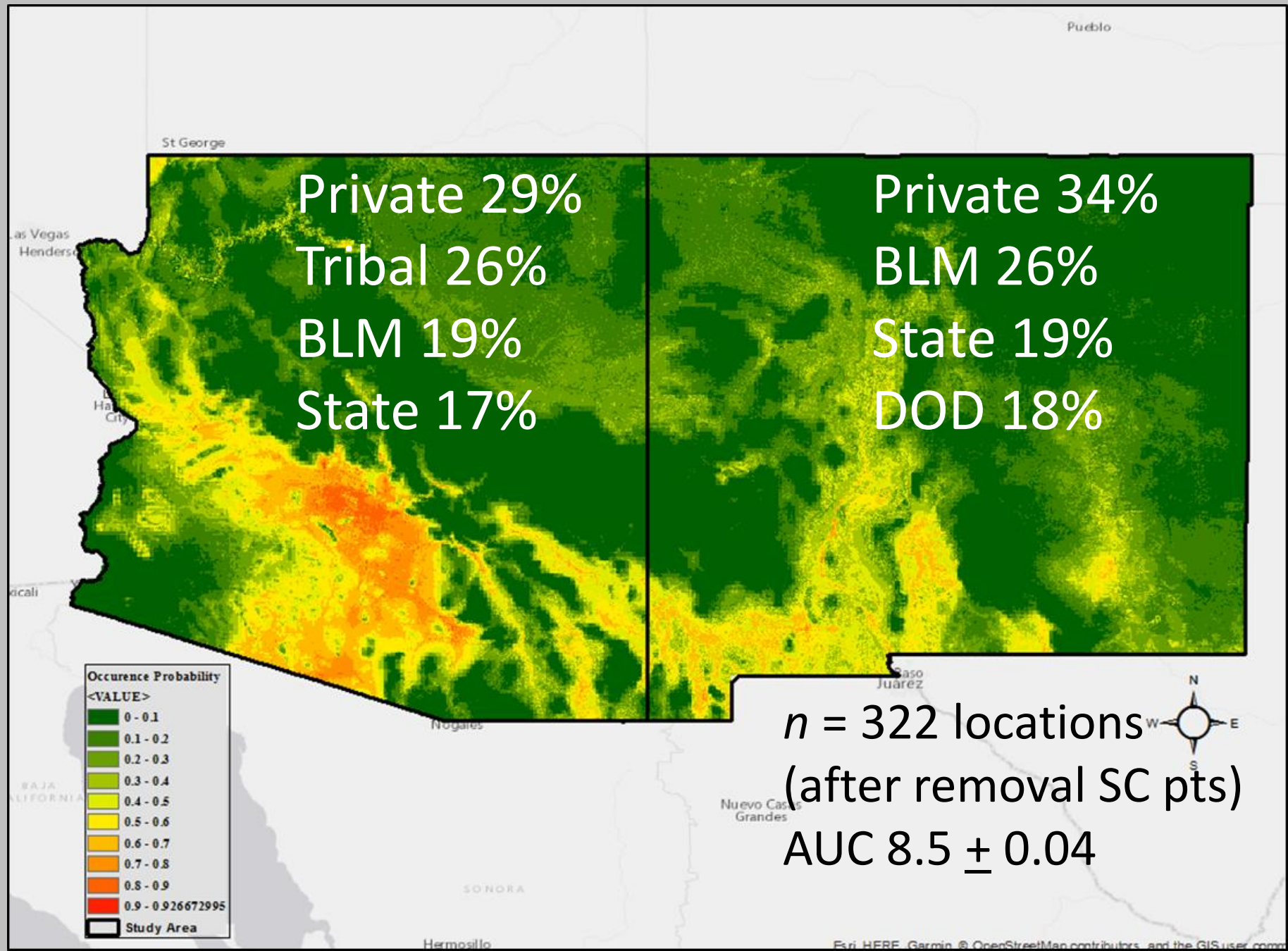
Species Distribution Model of BETH in NM and AZ

- Predicting current breeding distribution and hot spots for BETH using presence only data
- Identify major land managers

<u>SDM Variables</u>

BS Max Temp -54%
Bioyr precip -32%

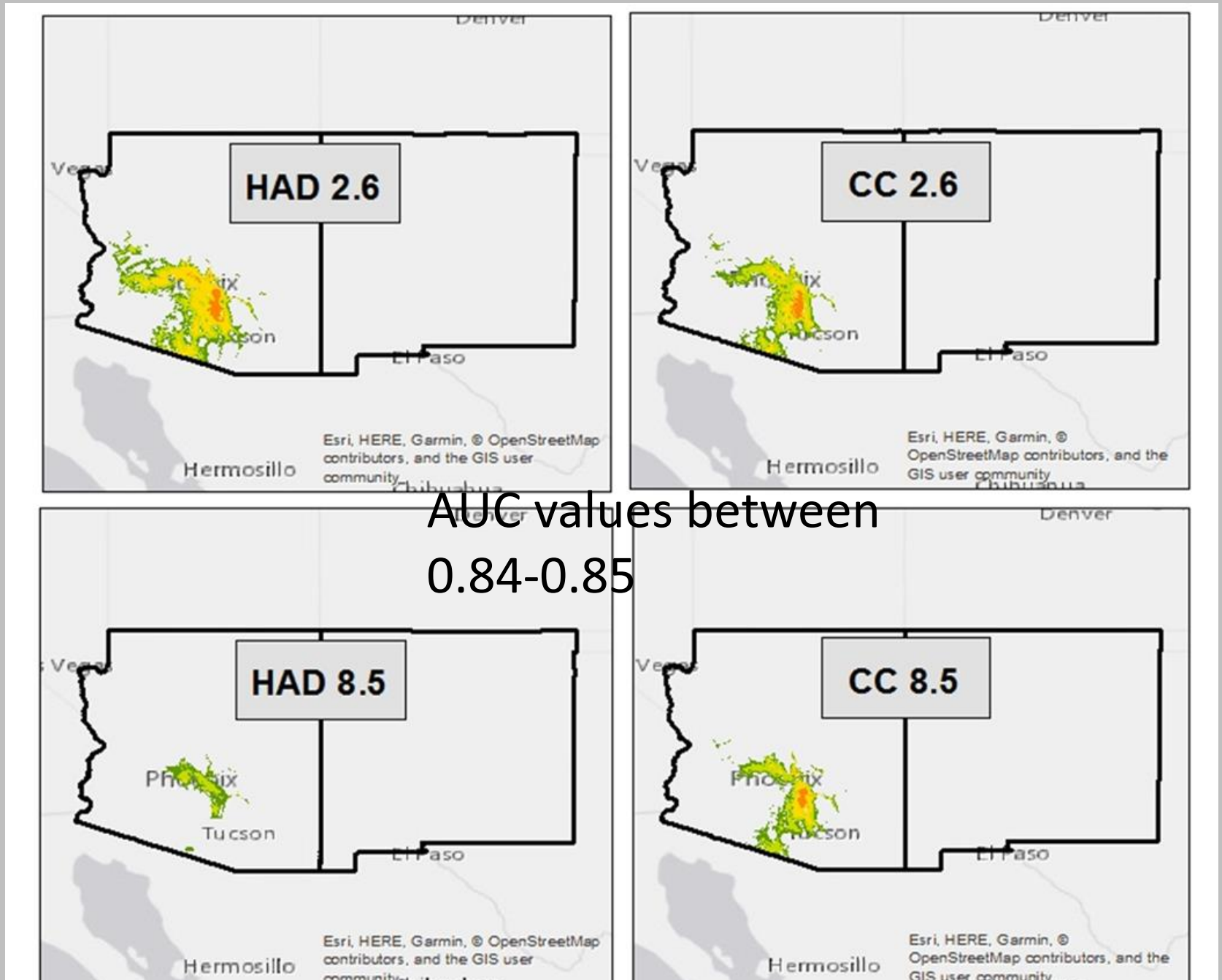
Elevation
Slope
% Cover



n = 322 locations
(after removal SC pts)
AUC 8.5 ± 0.04

BETH Distribution with Future Climate Scenarios

Two Climate Projection models with two greenhouse gas Representative Concentration Pathways (RCP 2.6 & 8.5)



AUC values between 0.84-0.85

<u>Model variables</u>

Bioyear Precip

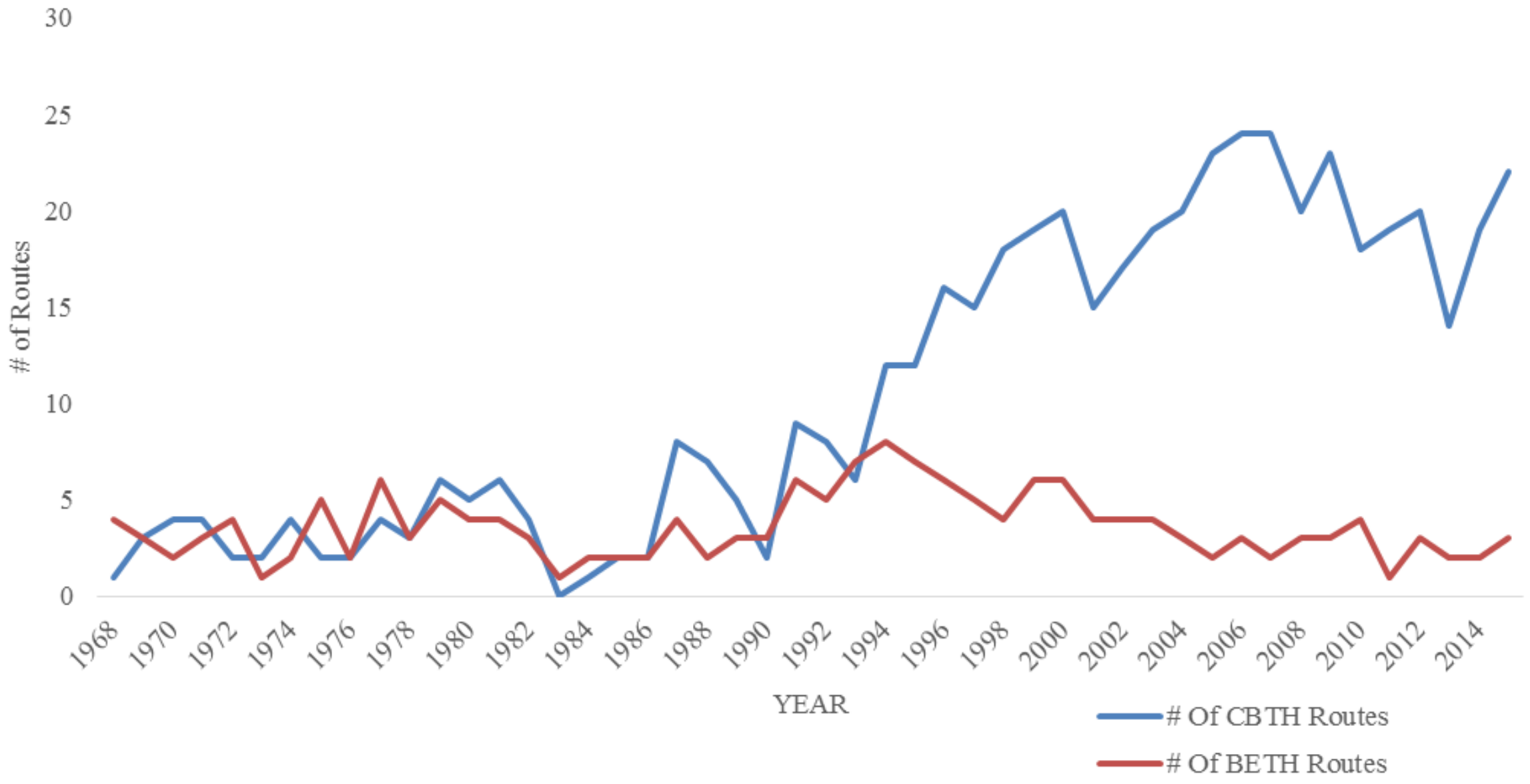
BS Max Temp

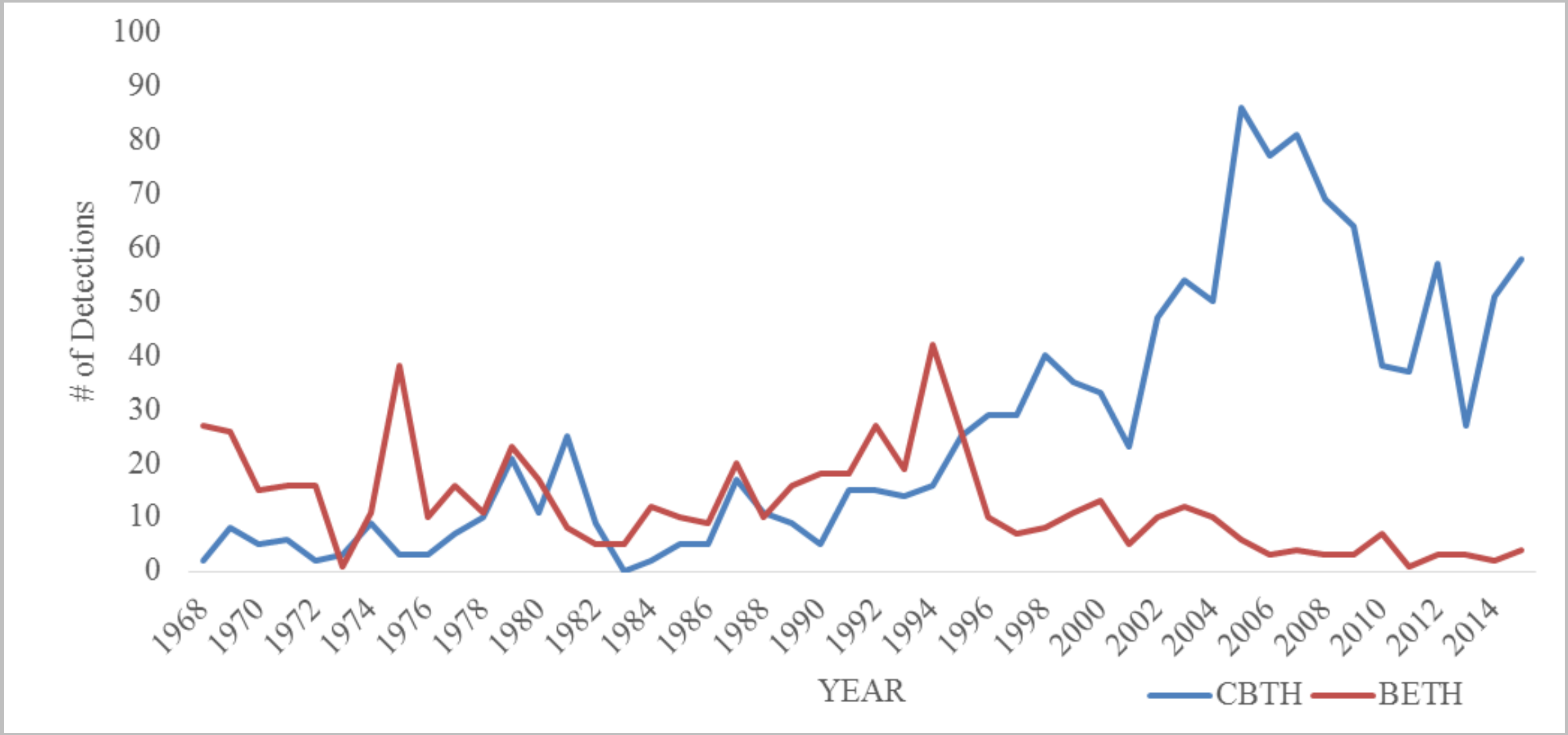
Elevation

Slope

Acknowledgments

- Tucson Audubon Volunteers
- NM Audubon Volunteers
- Technicians:
- Alison Salas
- Odd Jacobson
- Jasmine Johnson
- Daniel Horton


30
25
20
15
10
5
0
# of Routes
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
YEAR
Of CBTH Routes
Of BETH Routes


100
90
80
70
60
50
40
30
20
10
0
# of Detections
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
YEAR
CBTH
BETH

Bendire's Thrasher (BETH)

- Secretive, cryptic, and territorial
- Understudied since first described in 1872
- Current population estimates vary
  - 20,000-170,000
- IUCN: Vulnerable (BirdLife International 2012)
- American Bird Conservancy U.S. WatchList
- 20-40% of population in NM
- Population declining 4.61% annually
  - Fastest declining aridland bird