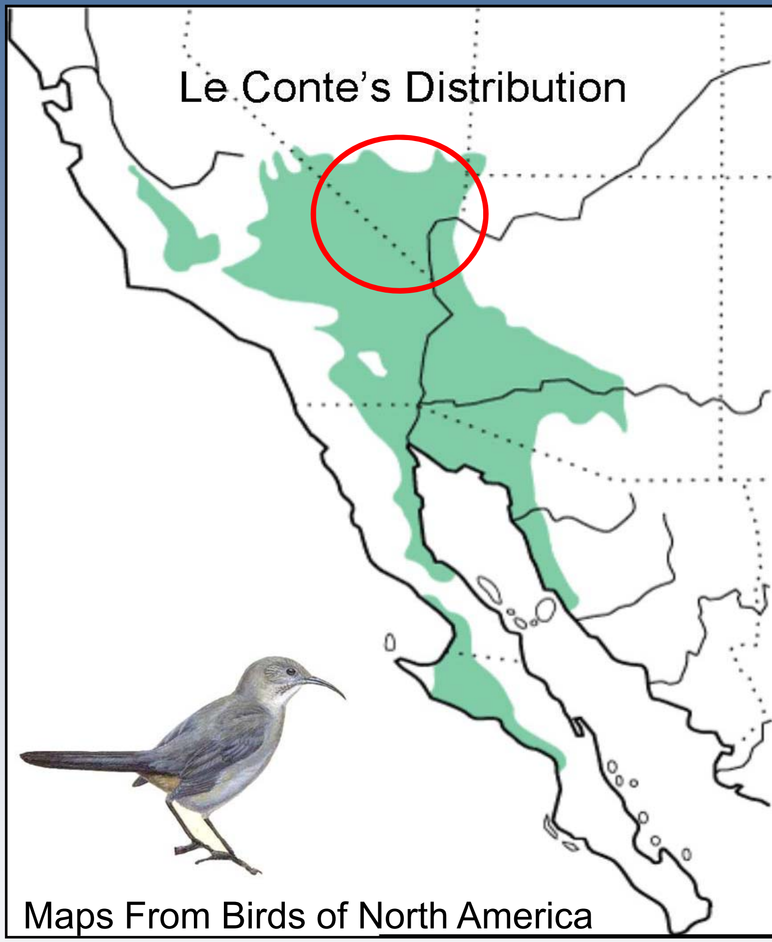
Distribution and site selection of Le Conte's and Crissal Thrashers in the Mojave Desert

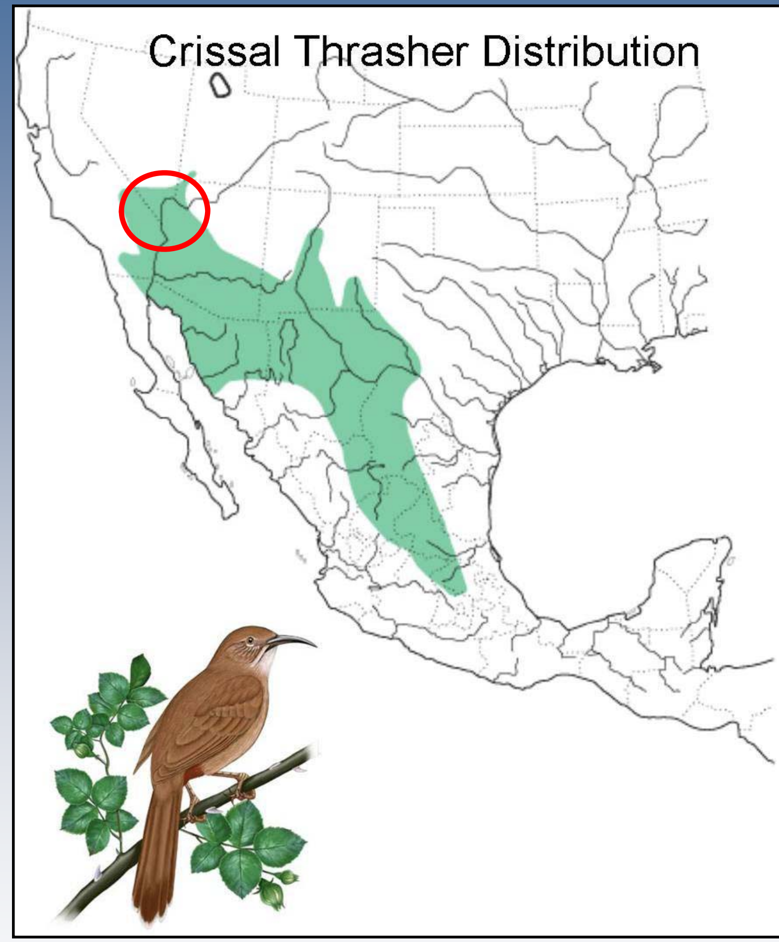
Dawn Fletcher[1, 2], Jef Jaeger[1, 2]
Cheryl Vanier[2], Dan Thompson[2], John Klicka[3]

[1]Public Lands Institute, [2]School of Life Sciences, and [3]Barrick Museum,
University of Nevada, Las Vegas

Distributions



Le Conte's thrasher occurs within the Sonoran, Mojave, and Peninsular deserts



Crissal thrashers are more broadly distributed

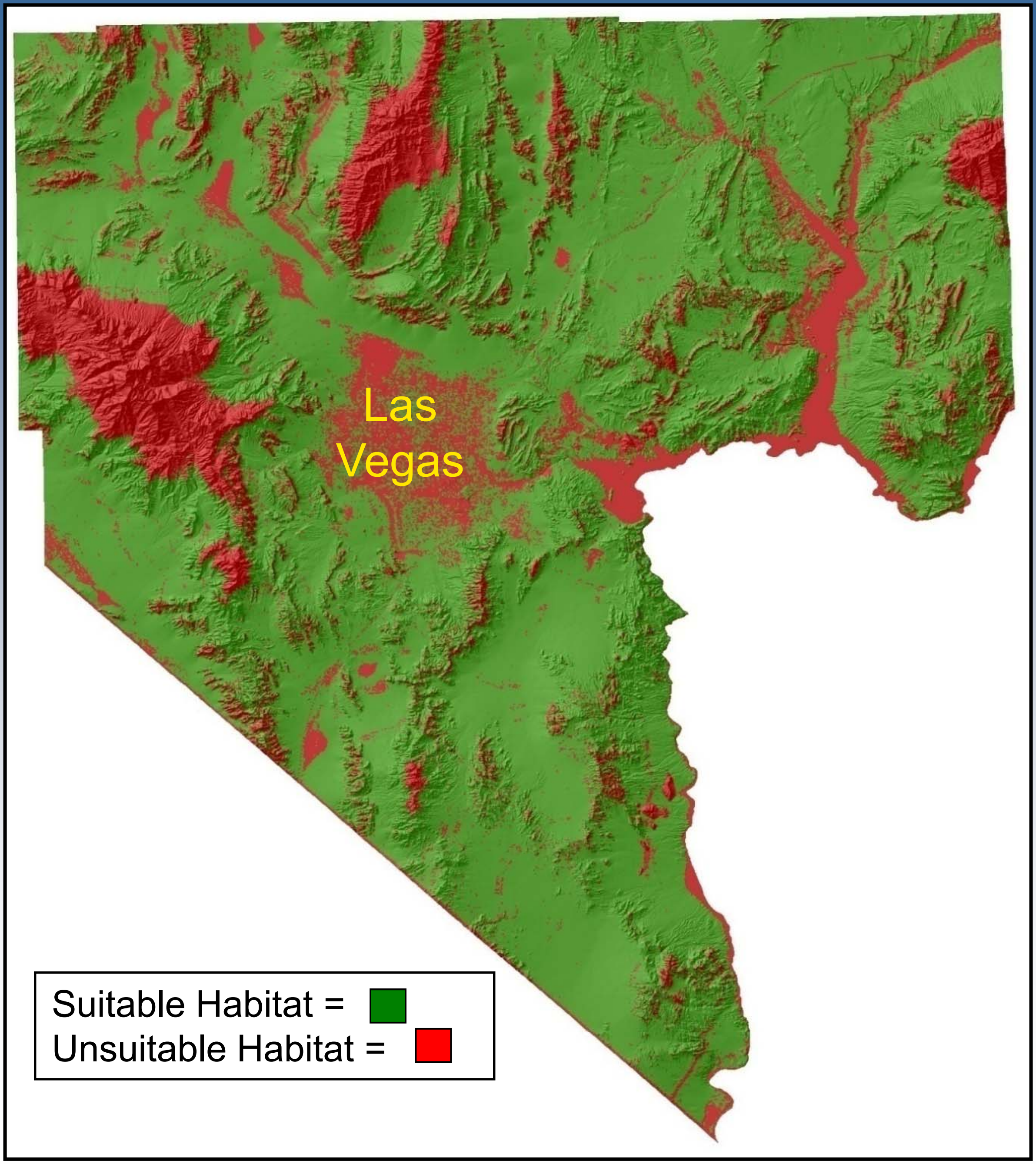
Background and Need for Project

- Low numbers and patchy distribution increase vulnerability to habitat change and local extinctions
- This problem is acute where urbanization is occurring rapidly
- Rare and elusive species and often undetected during point counts
- Current habitat models have limited predictive accuracy

Habitat Model from Southwest ReGAP for Le Conte's Thrasher

Map appears to overestimate suitable habitat

80% of Clark County predicted as suitable habitat



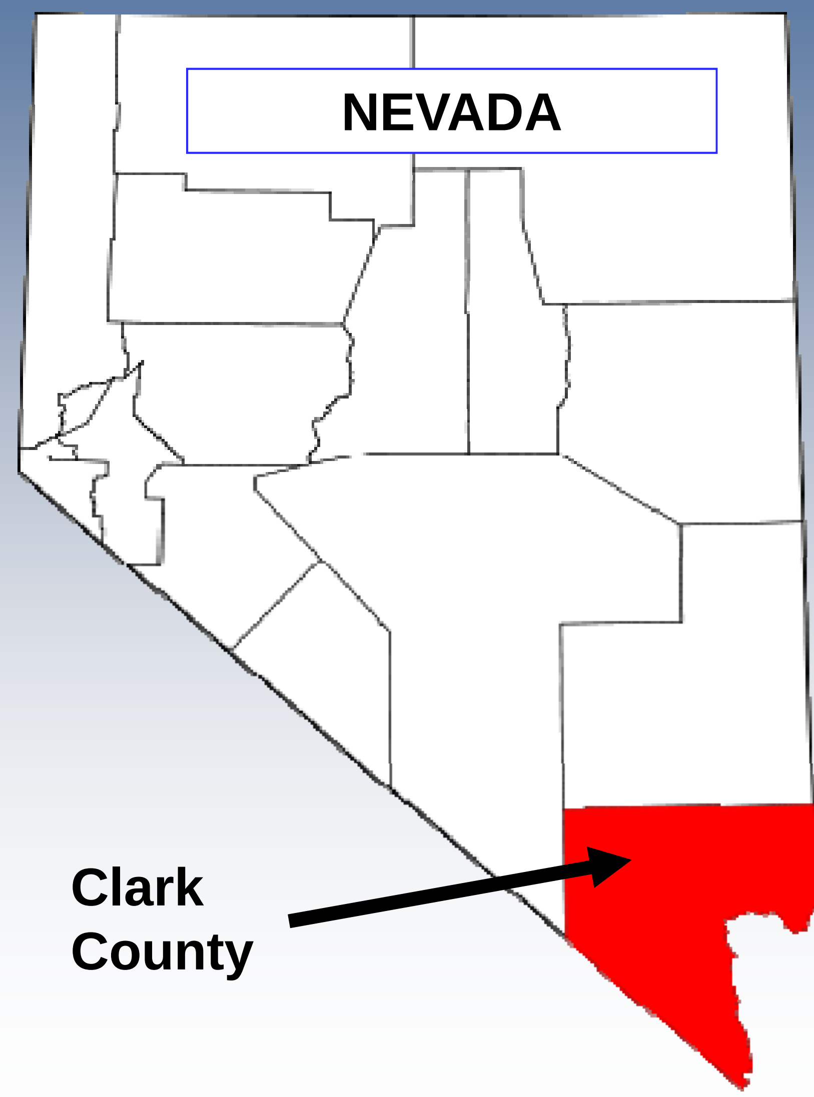
Project Goal and Objectives

Goal

- Understand the distribution and habitat use to inform conservation planning

Objectives

- Identify site-specific environmental influences
- Develop models and maps of suitable habitat



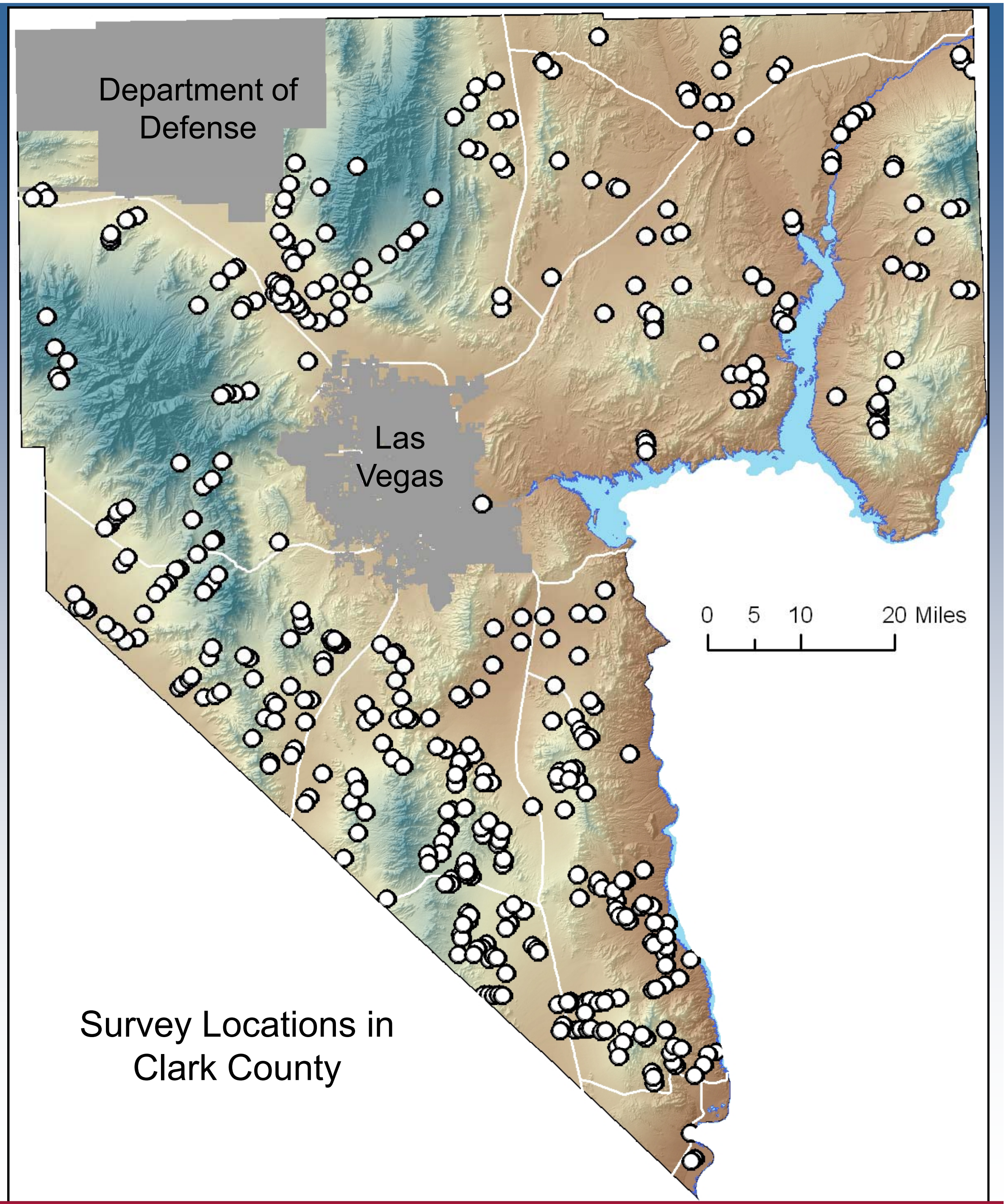
Primary Field Method:
Call-broadcast Surveys

Recorded calls of thrasher species played from portable loudspeaker

453 Random survey locations within Clark County

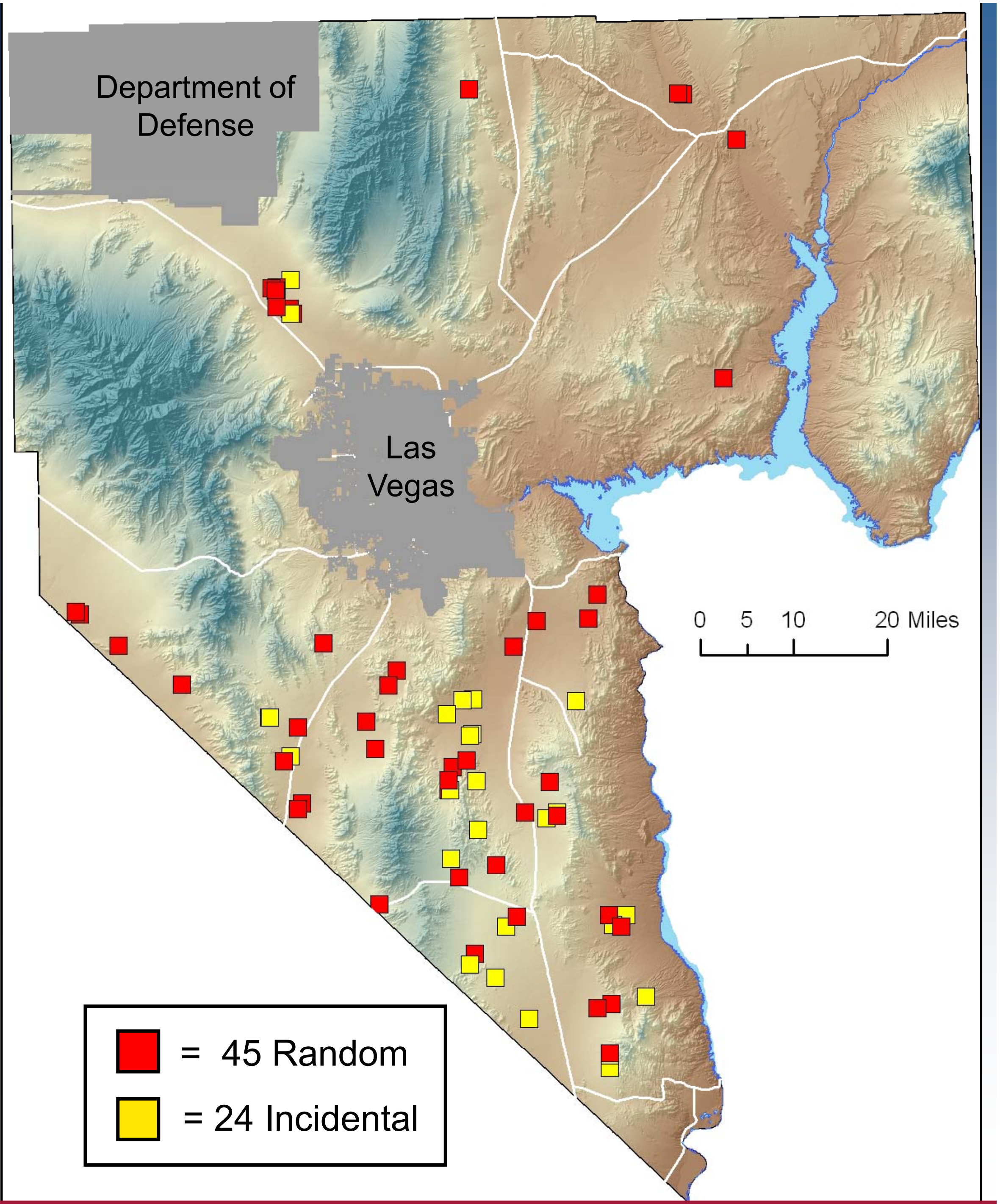
Stratified:

- 70% in major vegetation types and within 400m of roads
- 10% outside 400m buffer
- 20% within rare habitats



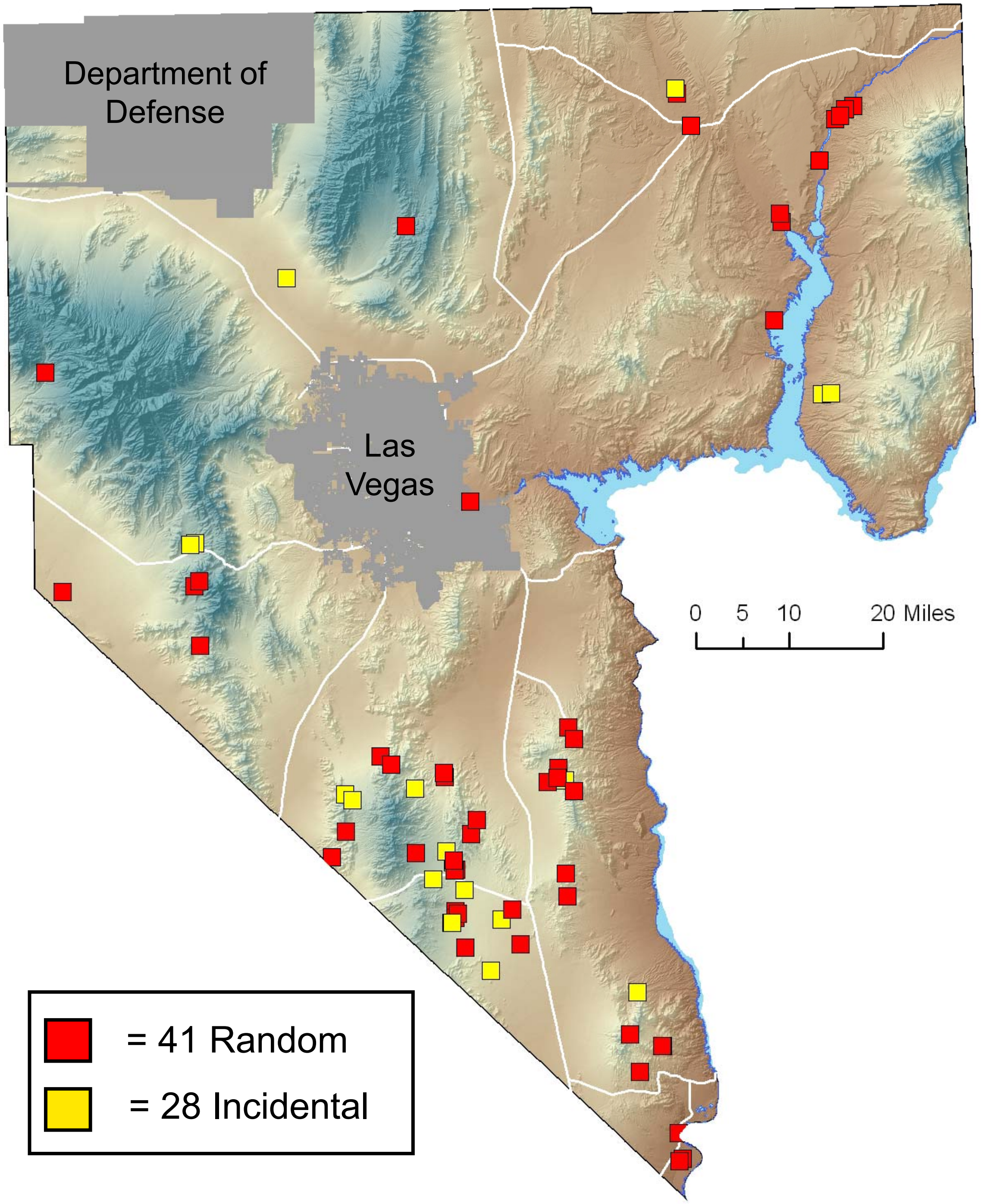
Le Conte's Thrasher Distribution

Map of positive observations



Crissal Thrasher Distribution

Map of positive observations



Main Analytical Approach Logistic Regression Analysis

Dependent variable – presence or absence of thrasher

Independent variables were fit using two models

1. Ecological model – created using site-specific data and data derived from digital spatial layers
2. Landscape model – created using data available or easily derived from digital spatial layers

Main Variable Groups

1. Plant assemblages
   – structure for nest sites, shelter, prey, etc.
2. Substrate
   – thrashers are ground foragers that excavate prey
3. Human Influence
   – thought to be sensitive to disturbance (assessed roads)

Main Variable Groups Continued

4. Physical landform features
   – increased vegetation in washes

5. Climatic Variables
   – impacts vegetation and bounds thrasher distribution
   – assessed through bioclimatic variables
   – reduced to 2 principal components representing patterns in elevation and latitude

Model Development and Selection

Information Theoretic Approach

- AIC_c scores used to rank and select among models (a metric that penalizes additional variables relative to the amount of variation explained)
- For both species numerous models were in best-fit sets
- Model-averaging – best estimator of coefficients for datasets with more than one best model

  Averaged coefficients are calculated from entire sets of models – coefficients represent magnitude and affect of variables

Results of Le Conte’s Thrasher Modeling

Le Conte’s thrashers were never associated with these variables (features):

1. Slopes > 5 degrees (n=126)
2. Pinyon Juniper (n=29)
3. Black brush (n=42)
4. Mountainous areas (n=38)

These variables were removed prior to model fitting to allow identification of other ecologically important variables

Model-averaged coefficients from best-fit **Ecological** models for Le Conte's thrasher

Variable	Coefficient	Lower 95% CI	Upper 95% CI
Lake plains	3.6500	0.9347	6.3653
Cholla	3.2665	0.6121	5.9209
Mojave Mixed Scrub	3.4344	0.7308	6.1381
Saltbush	6.3152	2.8352	9.7953
Wash Habitat	3.0302	0.3367	5.7235

* Variables shown that have strong association with Le Conte's thrasher presence (95 % confidence intervals do not including zero)

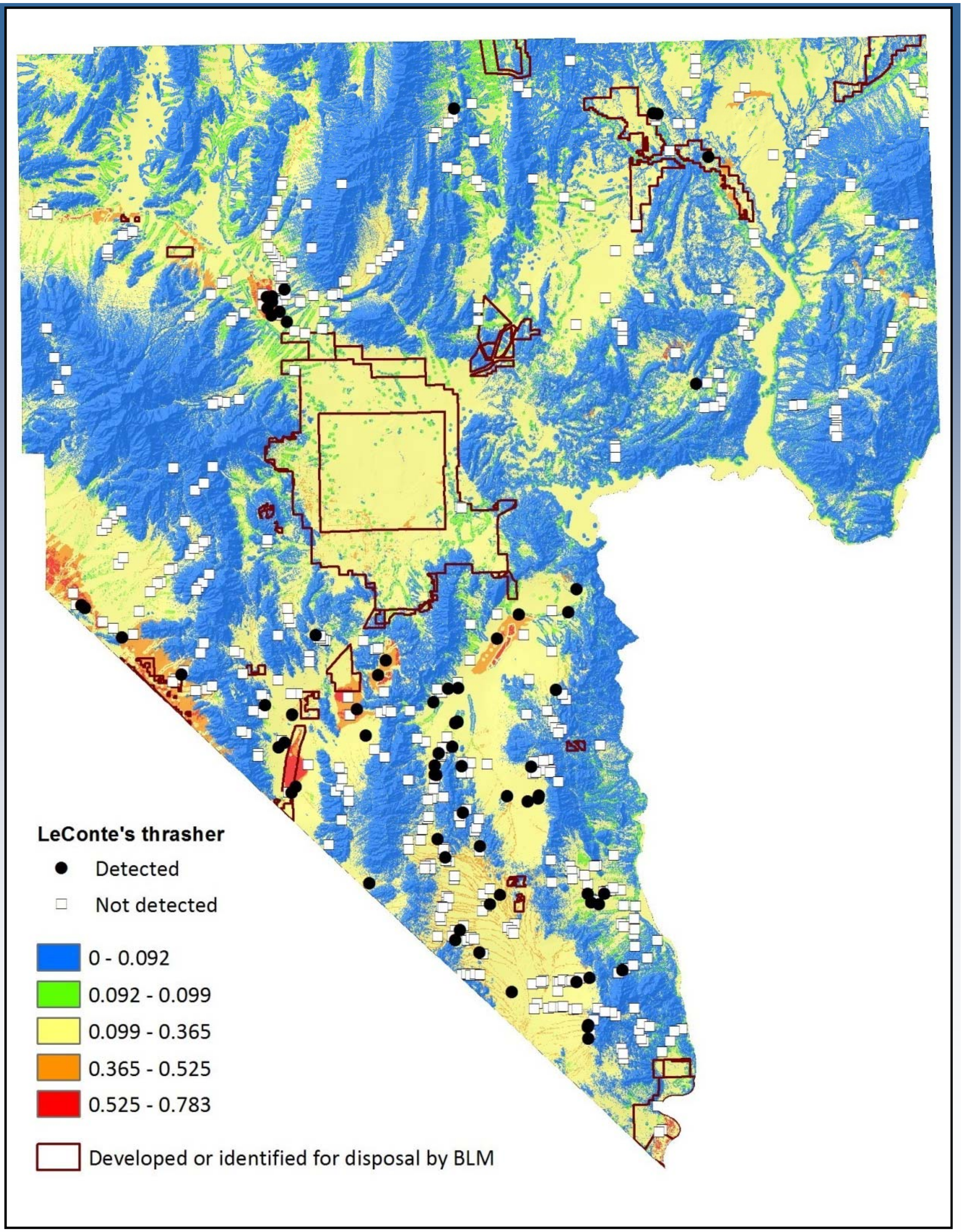
Results from model-averaging of best-fit **Landscape** models for Le Conte's thrasher

Variable	Coefficient	Lower 95% CI	Upper 95% CI
(Intercept)	-4.9770	-8.2022	-1.7518
Distance to road 300m	0.0002	-0.0008	0.0011
Creosote bush-white bursage	1.6813	-0.4905	3.8531
Mojave Mixed Scrub	2.6032	0.3223	4.8841
Saltbush series	5.9064	2.7266	9.0862
Wash habitat	2.7841	0.5096	5.0587
Landform Lake plains	1.9777	0.4085	3.5468
Presence of wash 300m	0.9832	-1.4073	3.3738
Prin2	0.0264	-0.087	0.1398

Predictive Habitat Map for Le Conte's thrasher

From the 9 landscape model-averaged coefficients

Identifies 4,000 km^2 as potential habitat out of 20,638 km^2



Results Crissal Thrasher

Variables negatively associated with Crissal thrasher

1. Creosote Bursage (n=77)
2. Sparse Joshua Tree (n =33)
3. Shadscale (n=27)

These variables were removed prior to model fitting to allow identification of other ecologically important variables

Results from model-averaging of **Ecological** models for Crissal thrasher

Variable	Coefficient	Lower 95% CI	Upper 95% CI
(Intercept)	-4.7846	-7.0834	-2.4858
Plant series Black brush	0.5999	-1.6674	2.8672
Plant series Joshua tree	0.4732	-1.4467	2.3931
Plant series Pinyon Juniper	-0.1495	-2.8912	2.5922
Plant series Riparian Mesquite	**8.1678**	**5.0153**	**11.3203**
Plant_series Wash habitat	**2.6367**	**0.8978**	**4.3754**
Dominant road class 300m	-0.0593	-0.2463	0.1278
Number of roads 100m	-0.0209	-0.1223	0.0806
Number of roads 300m	0.0149	-0.0586	0.0885
Presence/Absence of Wash 100m	0.3114	-0.8084	1.4312
Principle Component 1	**-0.3212**	**-0.5555**	**-0.087**
Principle Component 2	**0.6648**	**0.2289**	**1.1008**
Slope	0.0081	-0.0250	0.0412
Wash size 100m	0.0001	-0.0005	0.0008
Wash size 300m	0.0001	-0.0005	0.0007

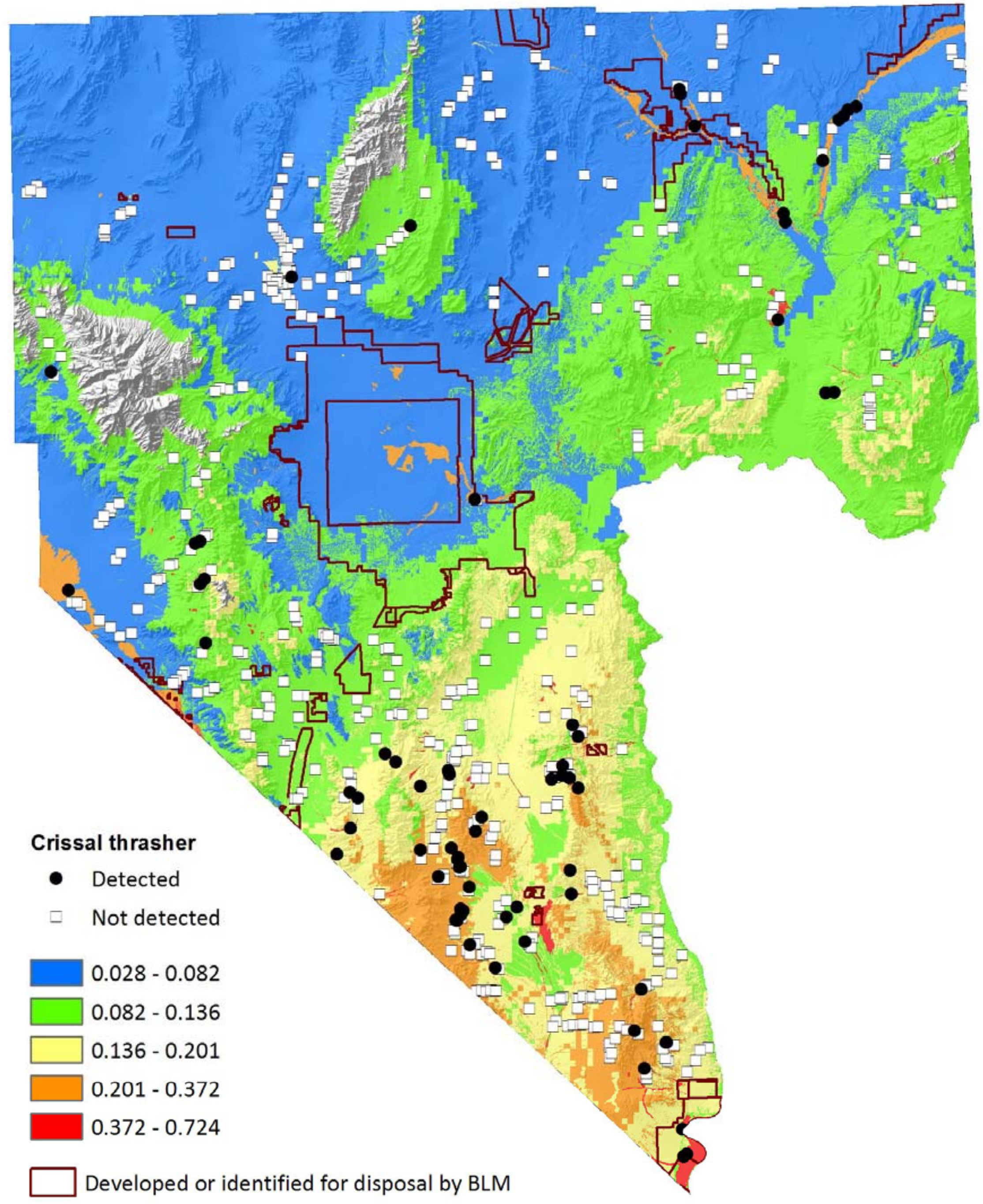
Results of model-averaging of **Landscape** models for Crissal Thrasher

Variable	Coefficient	Lower 95% CI	Upper 95% CI
(Intercept)	-4.7531	-6.7034	-2.8028
Plant series: Black brush	0.5678	-1.6783	2.8138
Plant series: Joshua tree	0.5709	-1.3630	2.5049
Plant series: Pinyon Juniper	-0.1430	-2.8643	2.5784
Plant series: Riparian and Mesquite	8.2521	5.1261	11.3781
Plant series: Wash habitat	2.7759	1.0313	4.5205
Principle Component 1	-0.3150	-0.5434	-0.0865
Principal Component 2	0.6461	0.2214	1.0709
Slope	0.0197	-0.0473	0.0867

Predictive Habitat Map for Crissal Thrasher

Based on 9 landscape model-averaged coefficients

Identified 5,677 km^2 of 20,638 km^2



Conclusions:
Crissal Thrasher Habitat Selection

- Prefers habitats dominated by riparian and wash vegetation

- Strong influence of elevation and latitude, indicated in relationship of PC1 and PC2

  – Follows patterns observed in arid-dwelling species that reach northern limits within the eastern Mojave Desert

- Negative association with creosote bursage and shadscale dominated habitats

  Landscape and ecological models emphasizing the same variables

Conclusions:
Le Conte’s Thrasher Habitat Selection

Species occurs in areas of little topographic relief, such as near dry lake beds (playas)

This pattern is strongly evidenced by:

- Negative relationship with slopes > 5 degrees, as well as upper elevation vegetation and landscape features
- Positive association with saltbush assemblages typically associated with the lower elevations

Joseph Hutcheson

General Conclusions

Both ecological and landscape models are important

- Ecological models captured habitat features not readily available as spatial data layers and inform broader-scale modeling

- Landscape models enable predictive habitat maps
  - Applied across broad scale for conservation planning
  - Identify areas that are likely to be occupied
  - Allows estimates of habitat loss or potential loss

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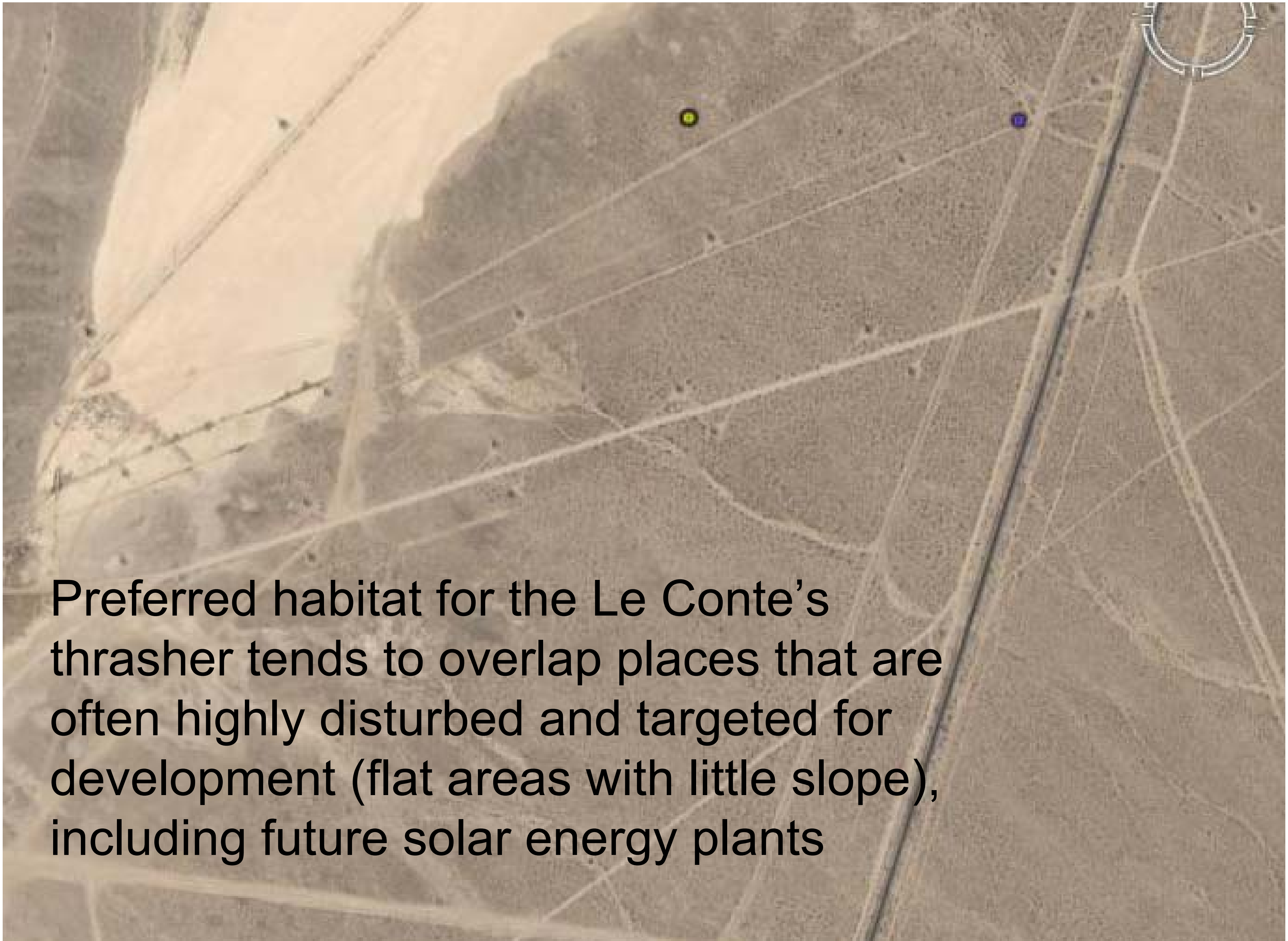
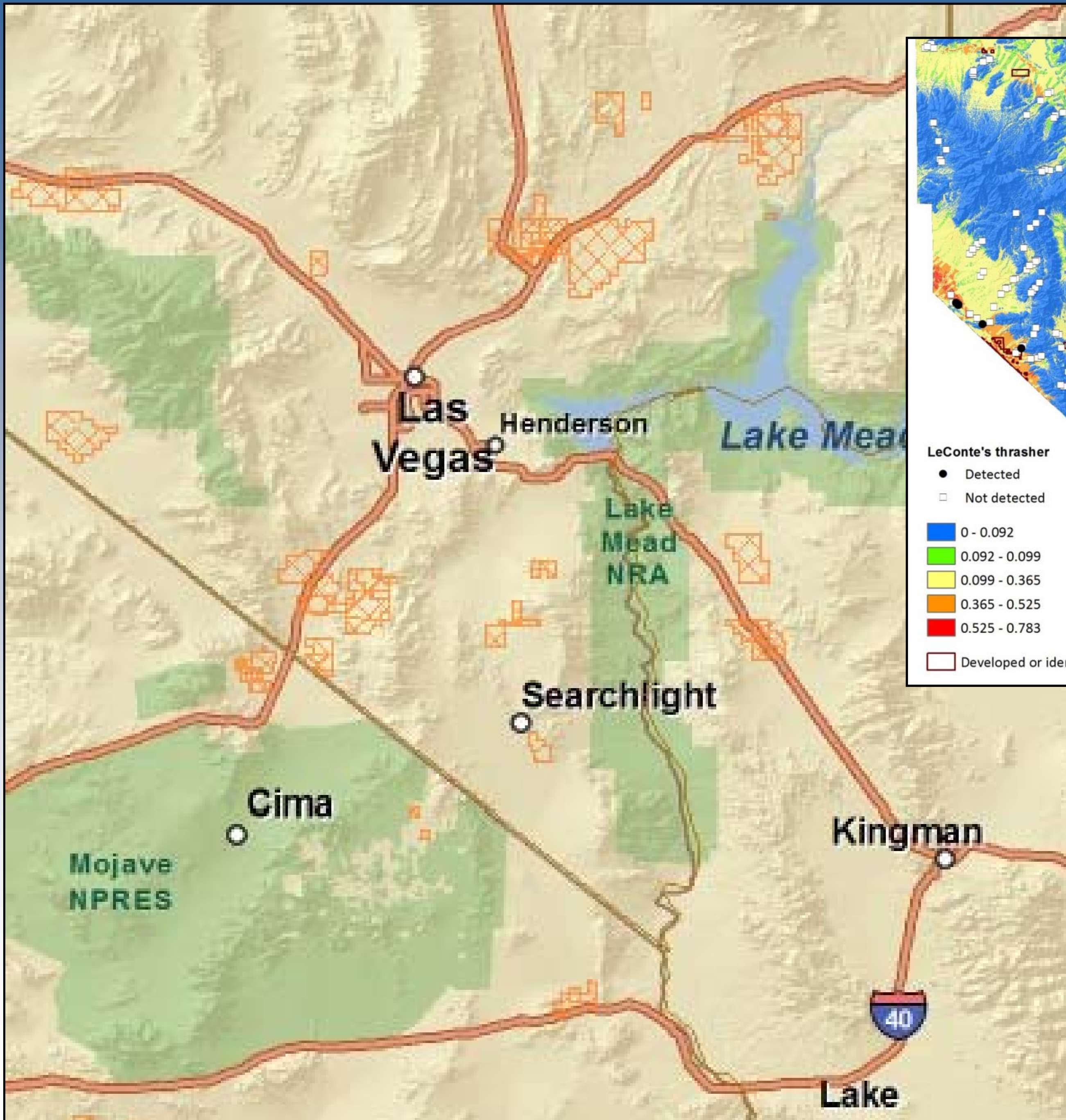
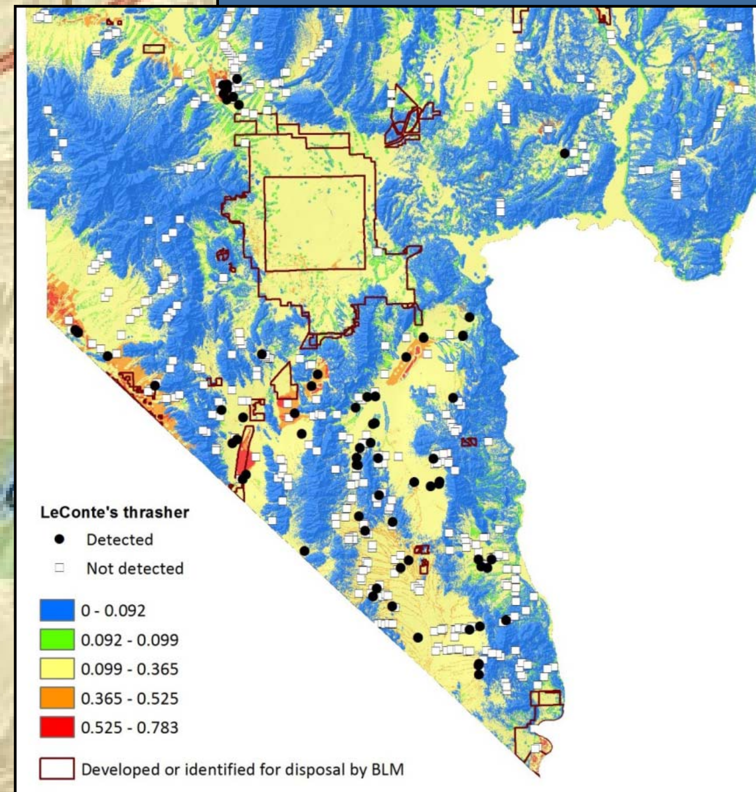
Joe Barnes
Mitch Urban

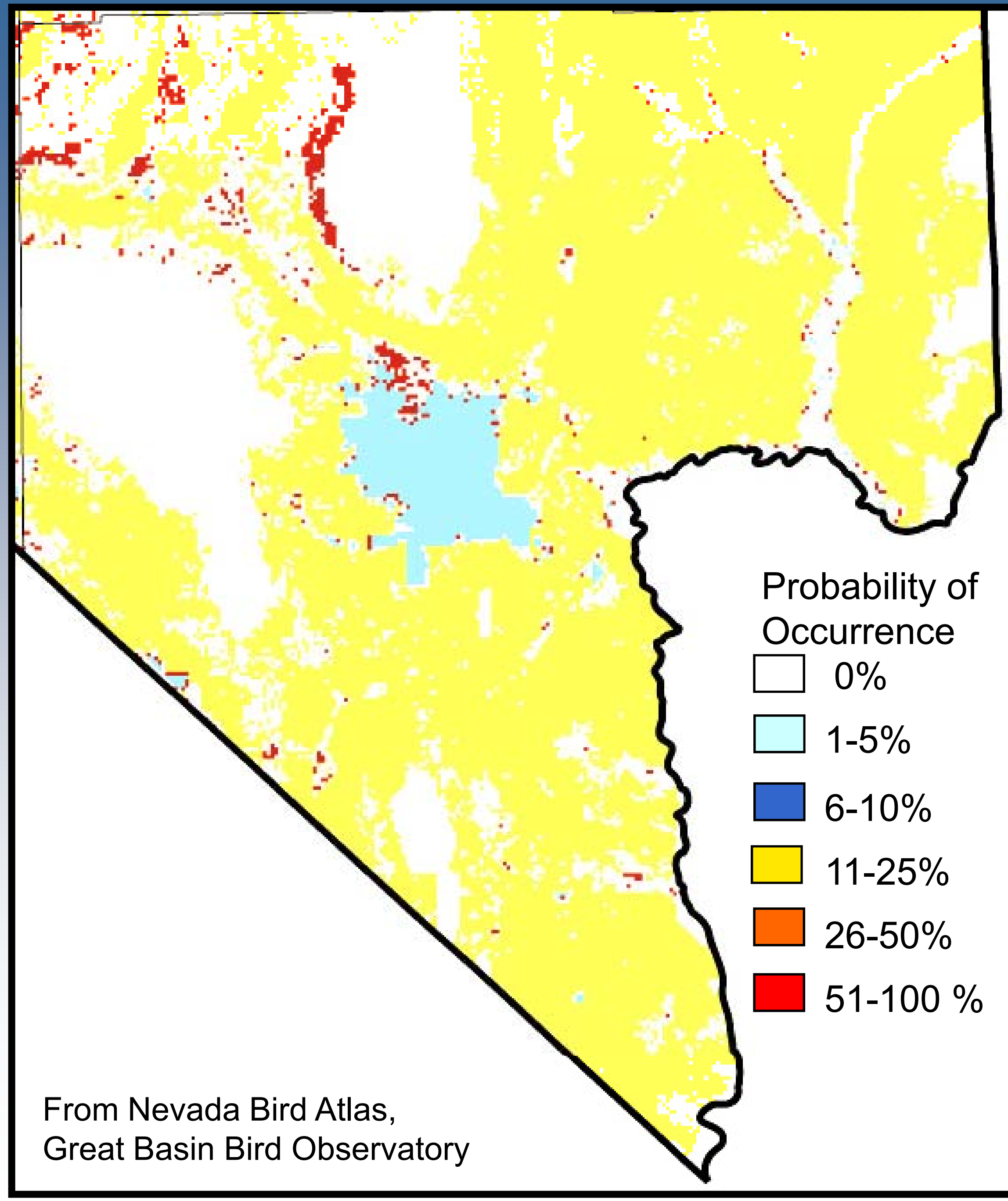


Preferred habitat for the Le Conte's thrasher tends to overlap places that are often highly disturbed and targeted for development (flat areas with little slope), including future solar energy plants

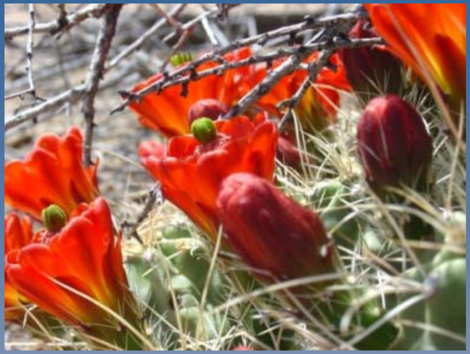

Las Vegas
Henderson
Lake Mead
Lake Mead NRA
Searchlight
Cima
Mojave NPRES
Kingman
40
Lake

LeConte's thrasher
Detected
Not detected
0 - 0.092
0.092 - 0.099
0.099 - 0.365
0.365 - 0.525
0.525 - 0.783
Developed or identified for disposal by BLM

Habitat Model for Le Conte's Thrasher

- Based on broad habitat categories
- Similar probability throughout County:11-25%
- Overestimates in north areas



Plant Assemblages



Presence of dominant plant species in the field

– Over 70 species recorded

Combined into plant assemblages for analysis

– based on previously classified vegetation communities for the Mojave Desert and assemblages perceived to be important

Plant Assemblages

1. Black Brush
2. Cholla series
3. Creosote Bursage
4. Joshua tree
5. Juniper series
6. Low Elevation Joshua tree
7. Mesquite Series

8. Mojave Mixed Scrub
9. Pinyon-Juniper
10. Riparian
11. Saltbush
12. Shadscale
13. Teddy-Bear Cholla series
14. Wash Vegetation

Image © 2009 DigitalGlobe
© 2009 Tele Atlas
Google
35°40'21.76" N 115°01'19.39" W
elev 2805 ft
Aug 30, 2006
Eye alt 5139 ft

Soil Texture Classification

Could not use soils for modeling because of the large number of variables (n=130) relative to sample size (n=453)

Analyses were based on the smaller number of soil textures associated with (and derived from) the identified soil types

Categories: clay, silt, sand, loam, fine, gravel, cobble, and stone

* Although soil types were not modeled it should be noted that a few soil types showed promising associations with thrashers based on Fisher's Exact tests

Landform Features

Landform features determined using soil survey database

- lake plain, flood plain, ballenas, fan remnants, mountains, hills, and drainageways

Washes were visually determined and classified using Google Earth

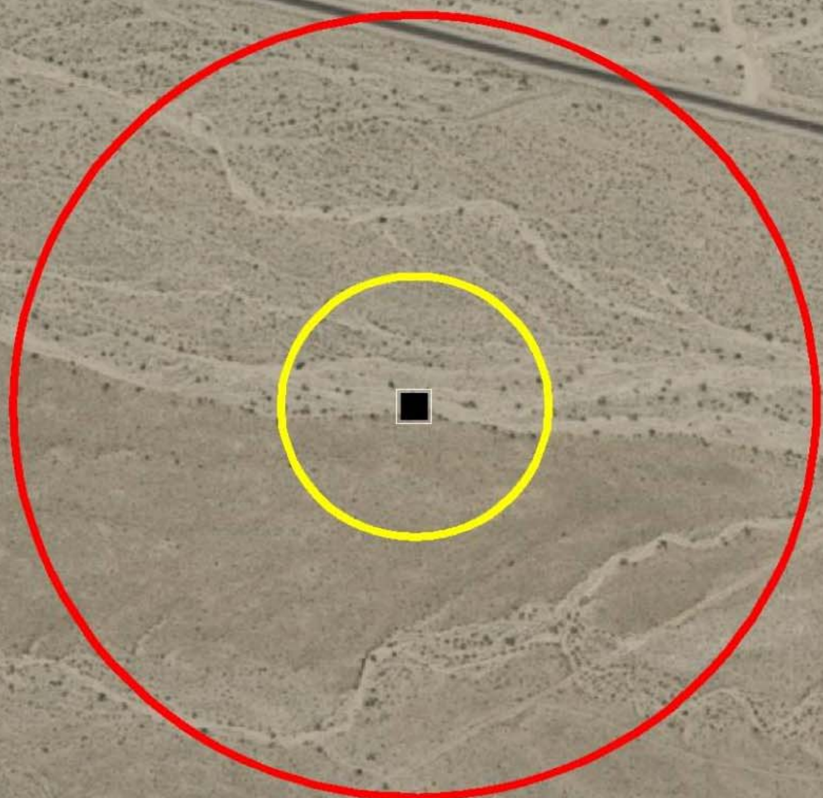
- average width of wash (if present)
- distance from survey location to wash

Human Influence

Human disturbance assessed from aerial images in Google Earth

- Number of roads
- Distance to largest road from survey location
- Classification of largest road
  1. Highway
  2. Secondary
  3. Major Unpaved
  4. Unpaved Maintained
  5. 4 x4 road
  6. ATV Track or Path

Call-broadcast may attract birds from distant locations where habitat might be different



Habitat features measured at two spatial scales:

- 300 m buffer – thrasher typically first detected within this buffer
- 100 m buffer – vegetative site descriptions based at this scale

Main Variable Groups

1. Plant assemblages
   structure for nest sites, shelter, prey, etc.
2. Substrate
   thrashers are ground foragers that excavate prey
3. Physical landform features
   increased vegetation in washes, soil texture
4. Human influence
   thrashers thought to be sensitive to disturbance
5. Climatic variables
   impacts vegetation (and soils), bounds thrasher distributions

Bioclimatic Variables

- 19 Bioclimatic variables obtained from WorldClim database
- Variables represent annual trends, seasonality, and extreme or limiting patterns in temperature and precipitation

- PCA used to reduce bioclimatic variables, and elevation, latitude, and longitude
- Two PCs explained 90% of the variation, and were easily interpreted
  - PC 1 – as elevation increases, precipitation increases and temperature decreases
  - PC 2 – lower annual and diurnal temperature range and high seasonality of precipitation are related to latitude

Justification for Creating Two Models

Spatial Scales

Site-specific (Ecological) models:

- tend to capture more information about the species than landscape-level (coarser scale) data

Landscape level models:

- collection tends to cost less (less time intensive)
- useful for generating predictive habitat maps