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University of Nevada, Reno

Modeling Potential Habitat, Landscape Genetics and Habitat Connectivity

Mohave Ground Squirrel
Xerospermophilus mohavensis

27 January 2011
California Energy Commission, Sacramento, CA

Photo - P. Leitner

U.S. Department of the Interior
U.S. Geological Survey

Mohave Ground Squirrel

Status

Mojave Desert endemic
Cal State Endangered Sp Act
ESA – under review

Photo – P. Leitner

Challenges

Urban development
Military training
Recreational activities
Renewable energy develop
Utility infrastructure
Transportation corridors
Roads
Subsidized predators

"delineating the remaining habitat and determining how to measure the quality of that habitat is of prime importance to land managers"

Research Team

Todd C Esque, USGS, coordination & habitat

Kenneth E. Nussear, USGS, ecological modeling

Phil Leitner, squirrel ecology & habitat

Marjorie D. Matocq, UNR, genetics & modeling

Peter J. Weisberg, UNR, ecology modeling

Susan Jones, USGS, project chief

Technical support:
Mojave Desert Ecosystem Program
California Department of Fish and Game
Other collaborations

Goals

Provide new and enhanced habitat suitability models for the the Mojave Ground Squirrel

Inform resource managers and evaluate the impact of solar energy technologies, plant designs, and/or solar project site selection

Provide planning tools to assist in the siting, design, permitting, and mitigation of solar energy projects

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Objectives

1. Analyze habitat potential: correlate presence points with habitat factors
2. Develop a potential habitat model for MGS with a 20-50 km buffer beyond the current geographic range map (Leitner 2008)
3. Develop response surfaces for landscape population genetics for MGS
4. ID occupied habitat & under-sampled areas
5. ID evolutionarily significant genetic corridors
6. Analyze current conservation corridors
7. Evaluate energy development sites relative to MGS

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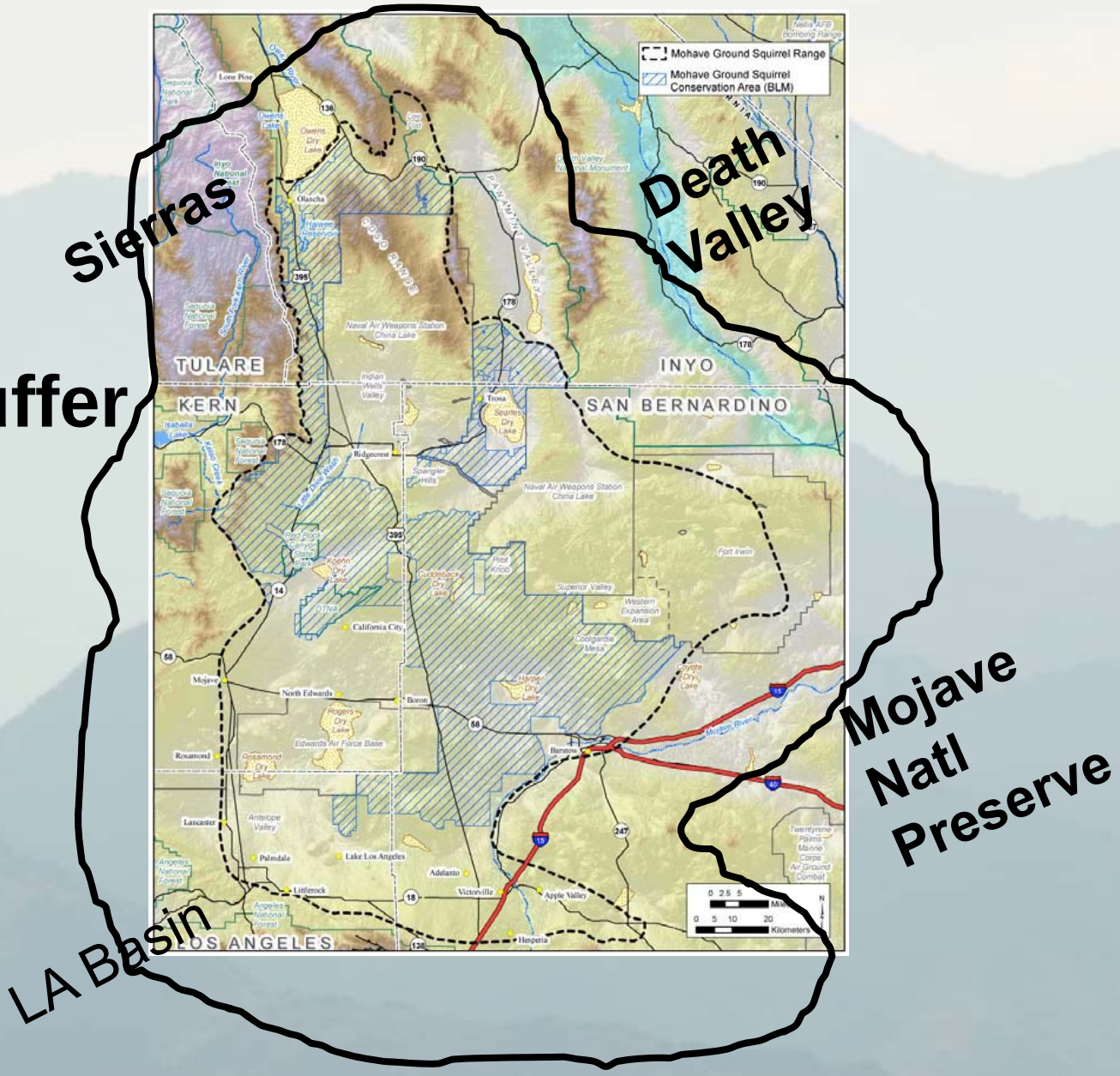
50 km buffer



P. Leitner 2008. *Adapted from* Transactions of the Western Section of the Wildlife Society 44: 11-29

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Methods

Data Acquisition

Data QA/QC, Reduction & Synthesis

Conceptual Modeling

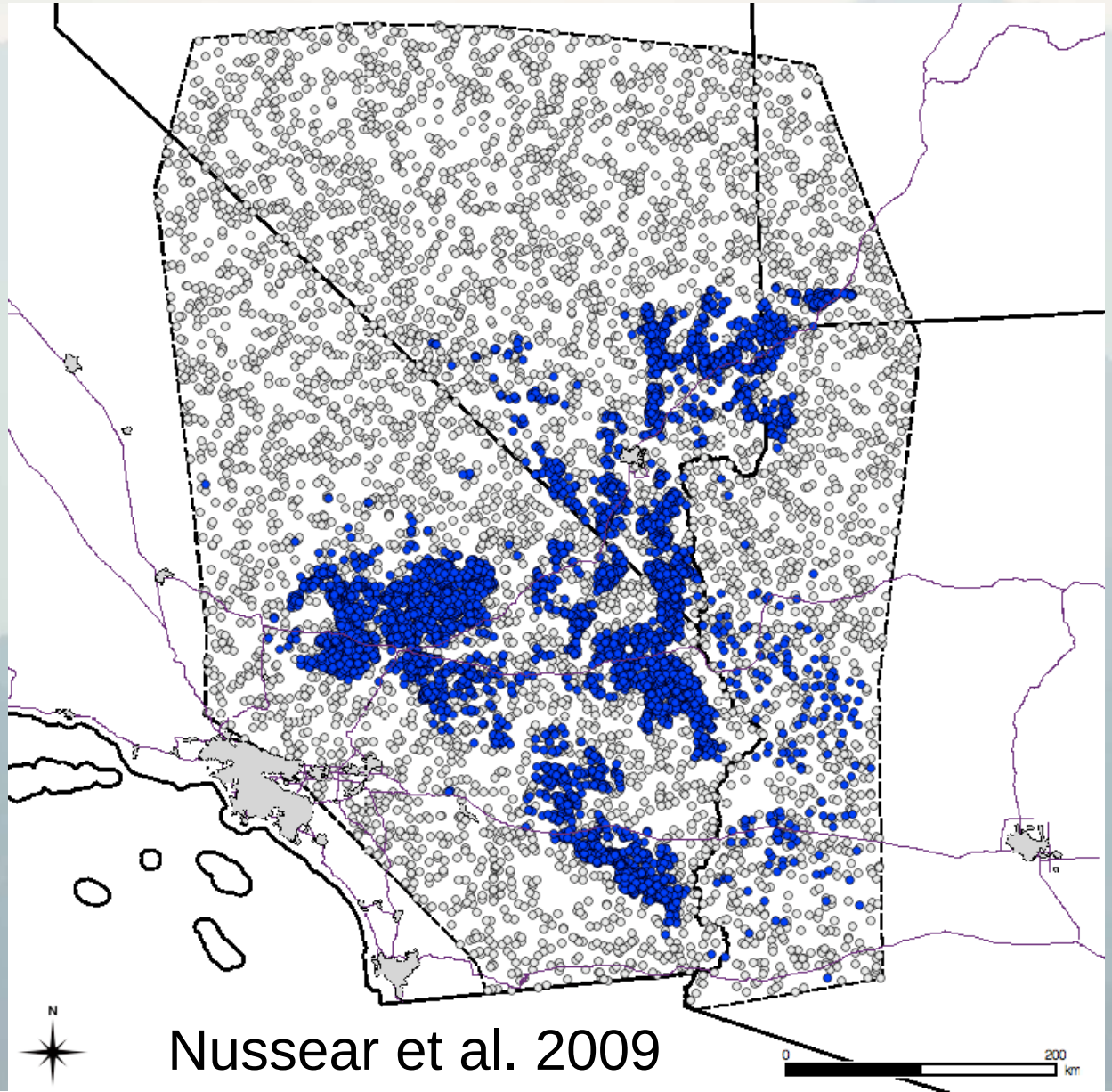
Data Layers

Modeling

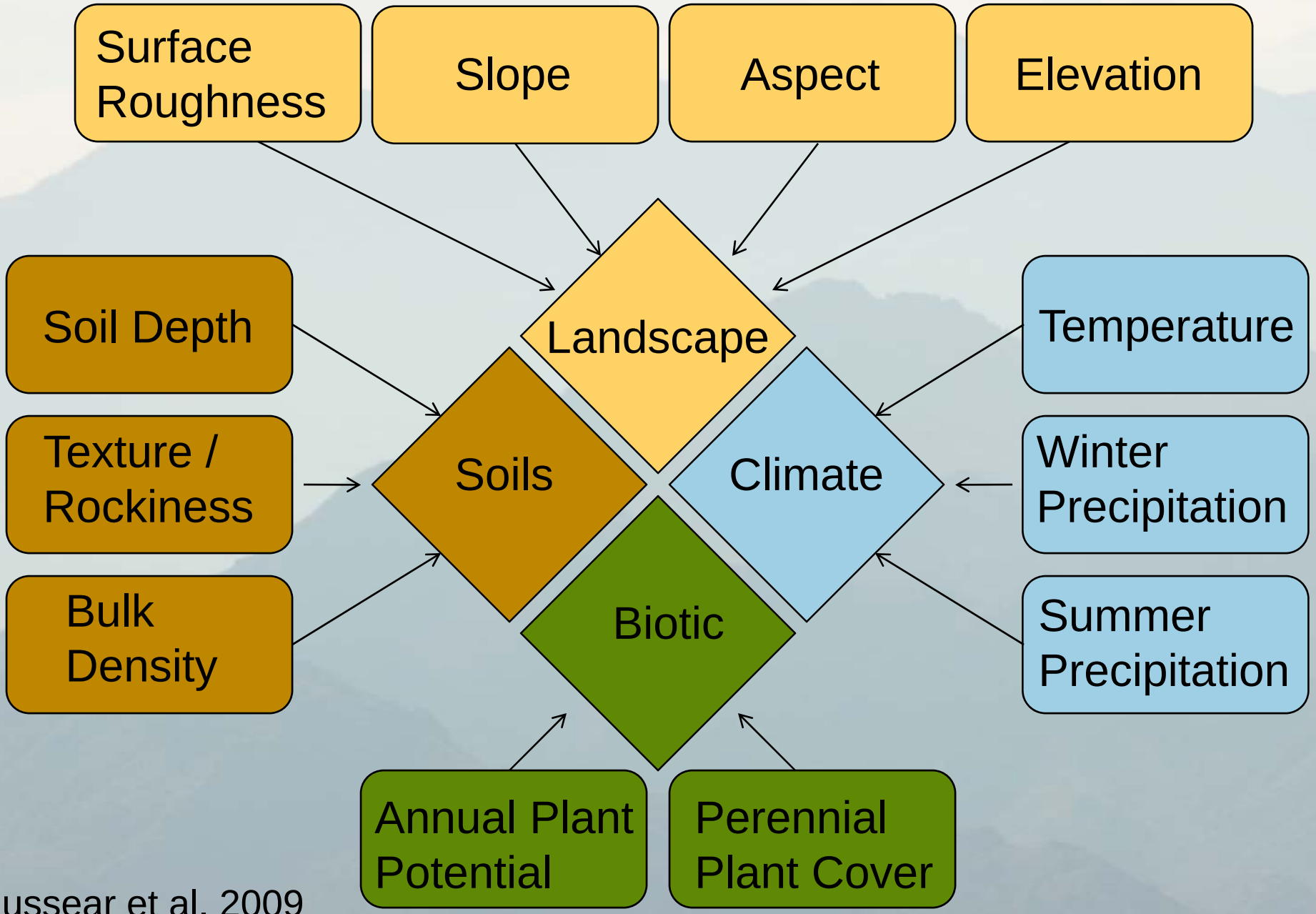
Testing & Validation

Synthesis & Analysis & Application

Ex. Tortoise Presence Data



Nussear et al. 2009



Nussear et al. 2009

Environmental Parameters

Elevation, Lakes and Playas

Slope (Digital Elevation Models)

Eastness and **Northness** (Zar 1999)

Soil - bulk density, depth, and avg. % rocks > 254 mm
(Nat. Res. Cons. Serv., mod. by USGS)

Surface roughness - "Surface Areas and Ratios from Elevation Grid" (Jenness, 2002)

- **Perennial Veg Cov** – MODIS-EVI (Wallace et al. 2007)
- **Annual Veg Cov** – MODIS-EVI (Wallace et al. 2007)
- **Precipitation** - > 400 sites across Mojave Desert
  (Blainey et al., *In Prep*) normal period: 1961 – 1990
  - dry season (May through October)
    also spatially distributed coefficients of variation
  - wet season (November through April)
    also spatially distributed coefficients of variation

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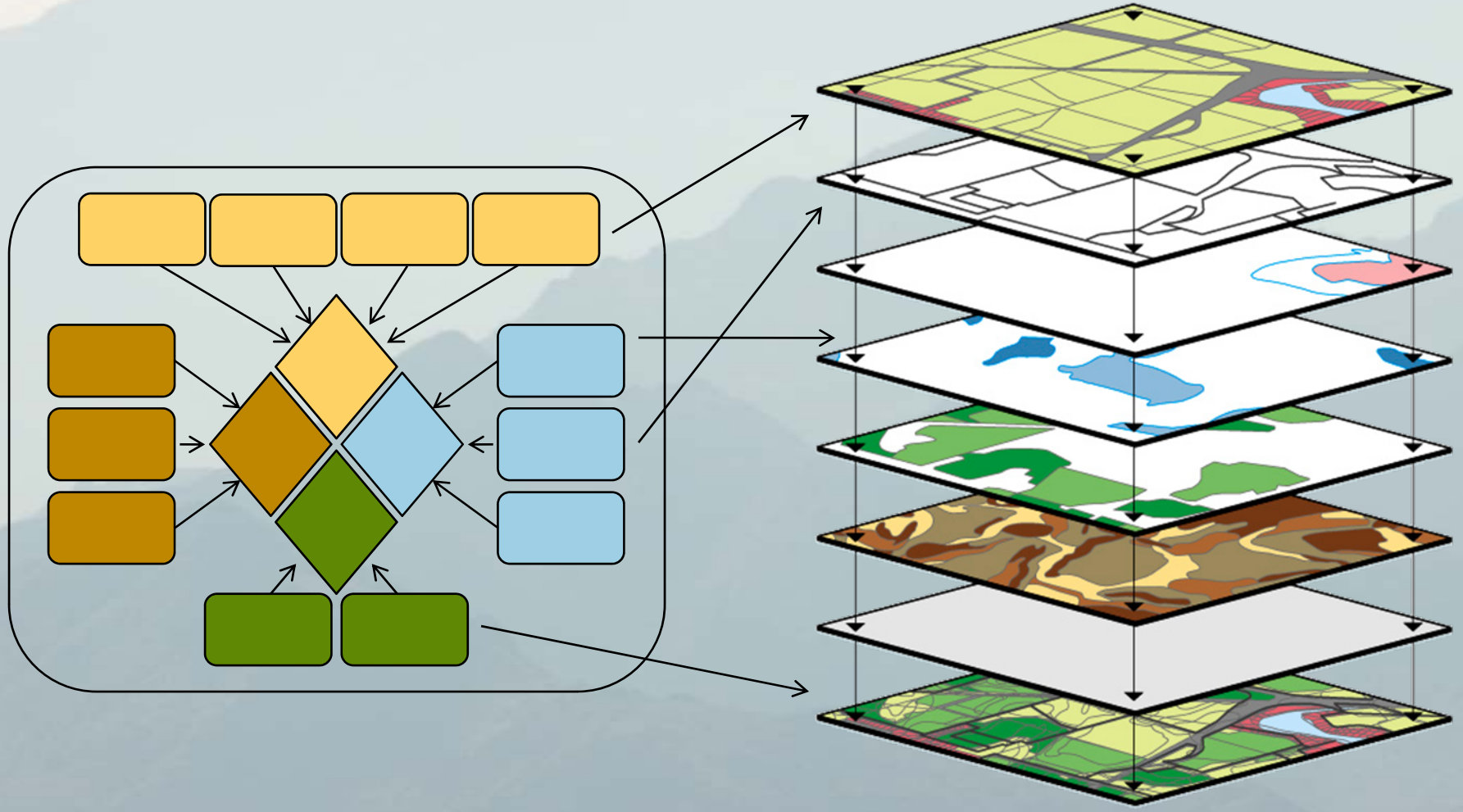
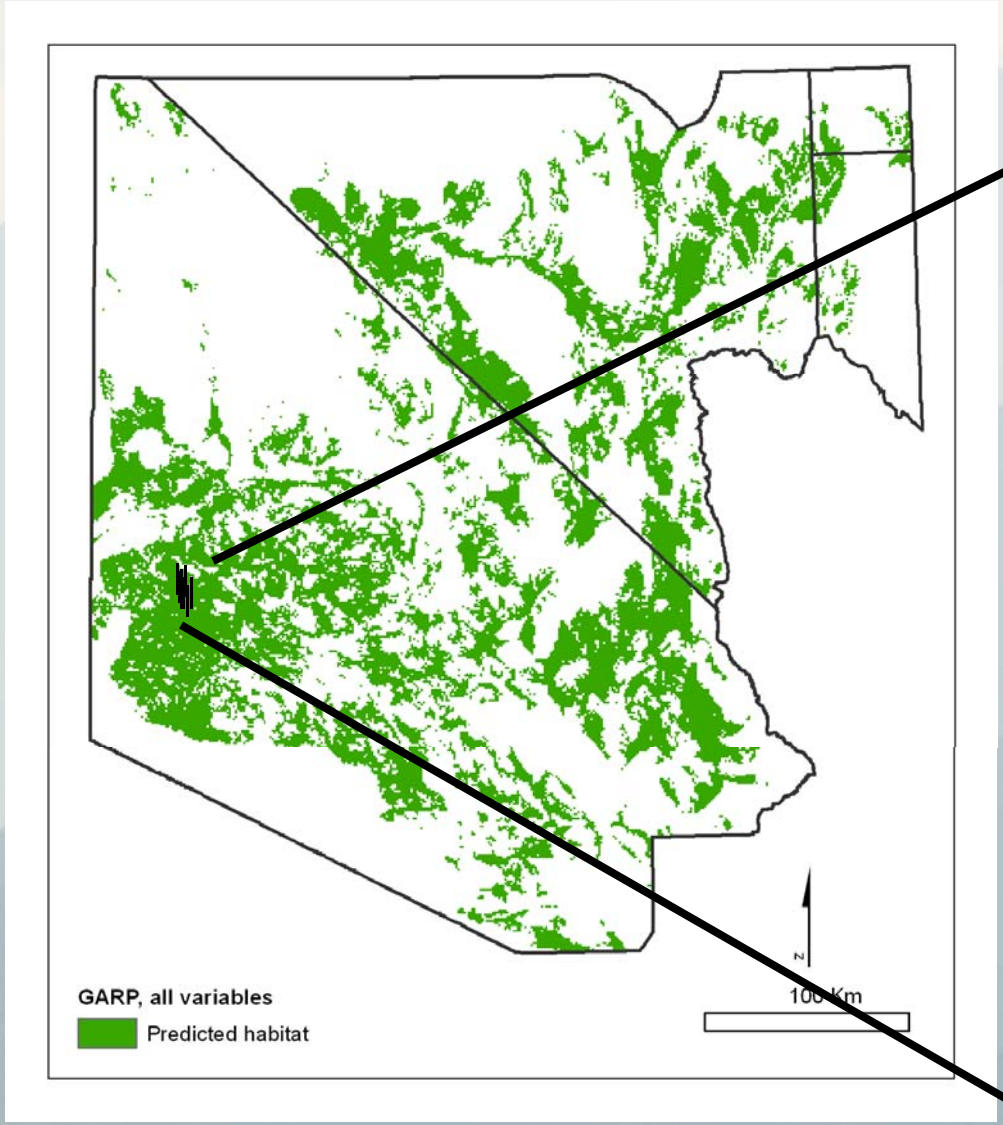
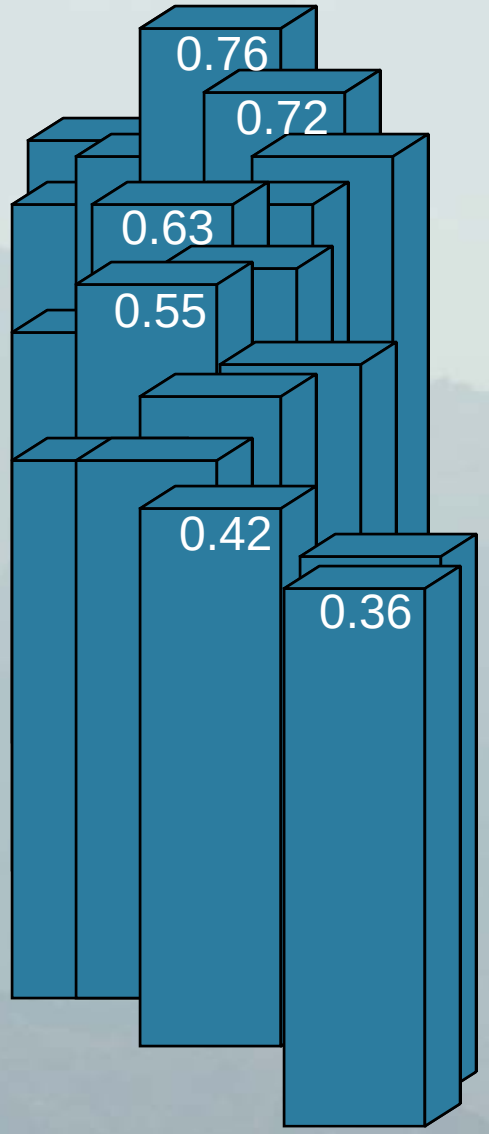
Conceptual Model to Data Layers



Ex. Mapping Approach For Decision-making





1 km² grid cell values

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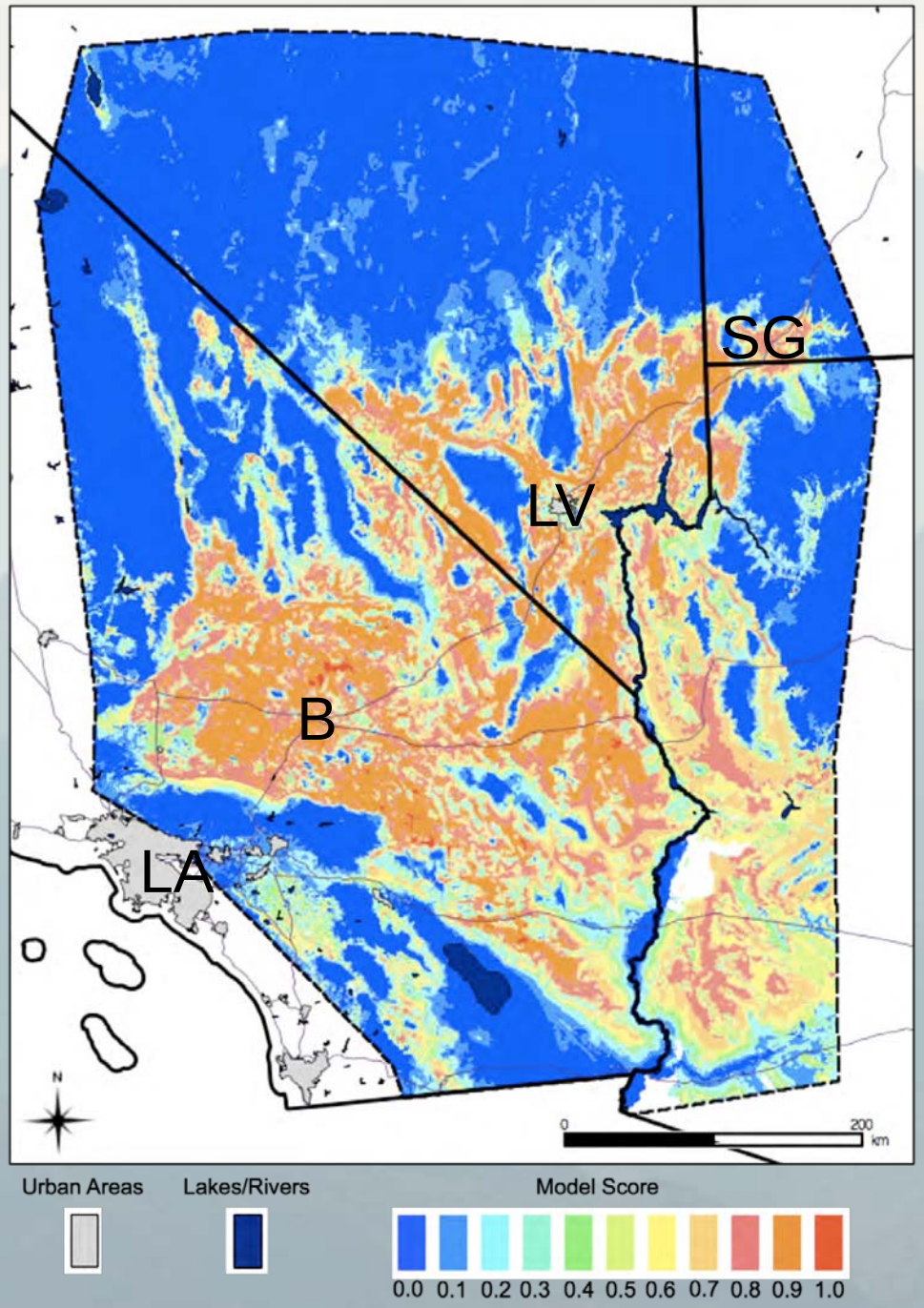
Ex. Desert Tortoise

Habitat Potential Model

Previously Undocumented Sites

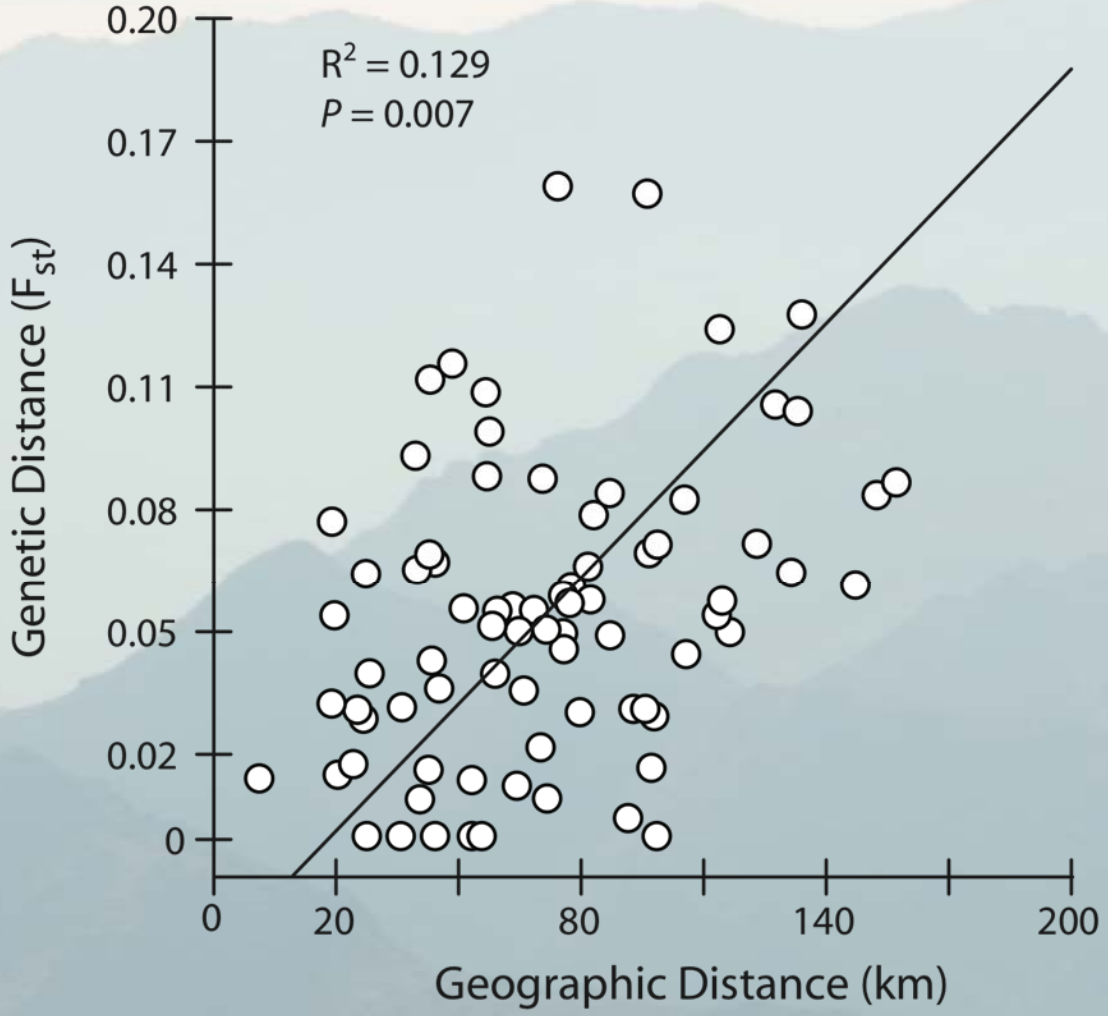
Data Gaps

Connectivity



Nussear et al. 2009

Mohave Ground Squirrel Data



Bell and Matocq, Animal Conservation in press

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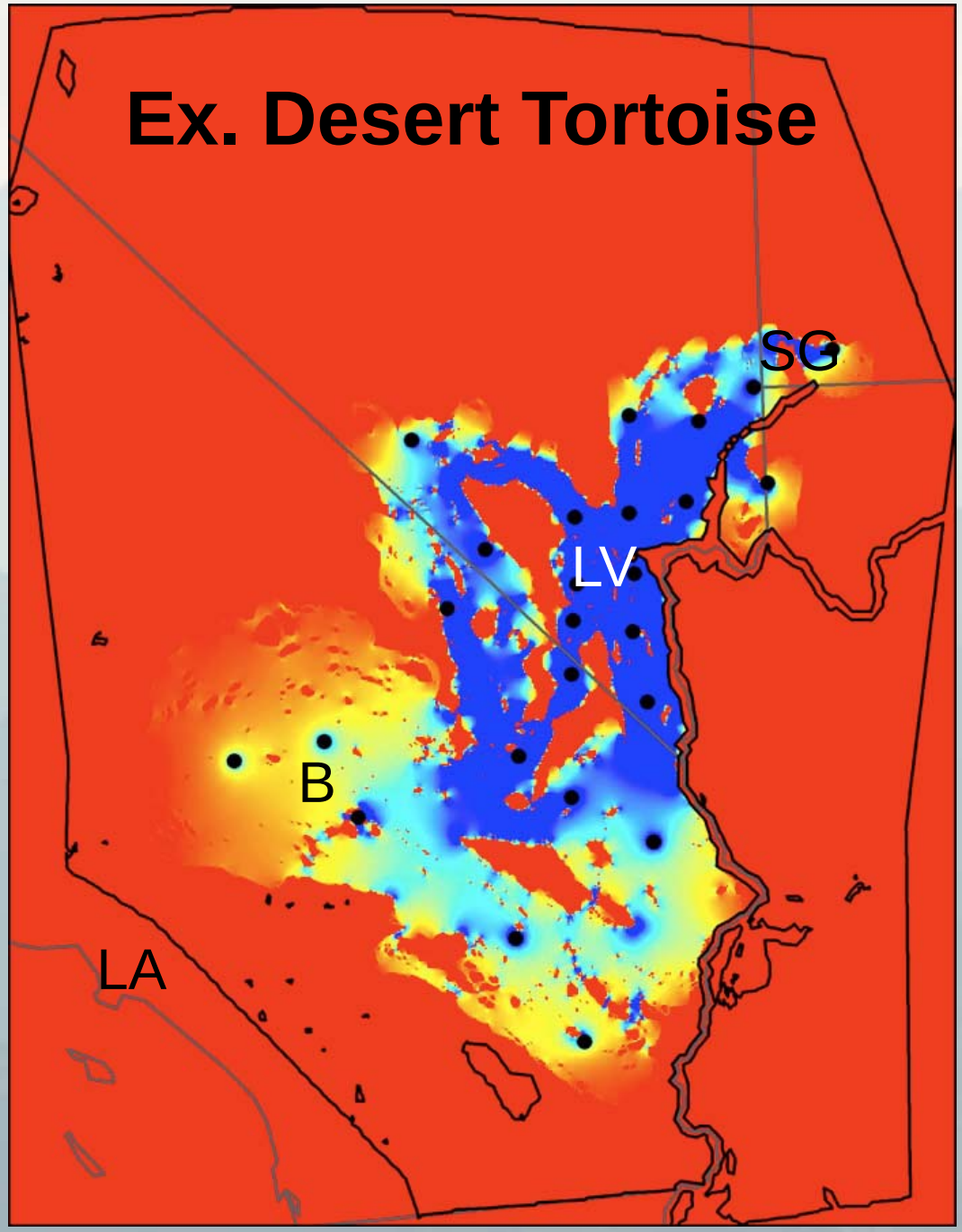
Cumulative current maps between populations from the isolation-by-resistance models (barrier)

Prob of tortoise movement
R = no current
Y and O = low current
B = high current
Black dots = 25 population centroids



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Deliverables

1. All data layers used in MGS models
2. Maps and accompanying databases for MGS dist
3. Future MGS distribution forecasts in relation to climate change
4. Maps of landscape connectivity for habitat preservation and/or restoration decisions and in relation to future climate projections.
5. Identification of key populations and areas of connectivity that maintain genetic variability and evolutionary potential of MGS.
6. Estimates of how population and regional genetic diversity will be impacted by shifts in landscape connectivity.

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Action Item

Locality data and metadata

Required to begin one important component of the work