Future directions: pushing the status of knowledge about desert tortoise connectivity

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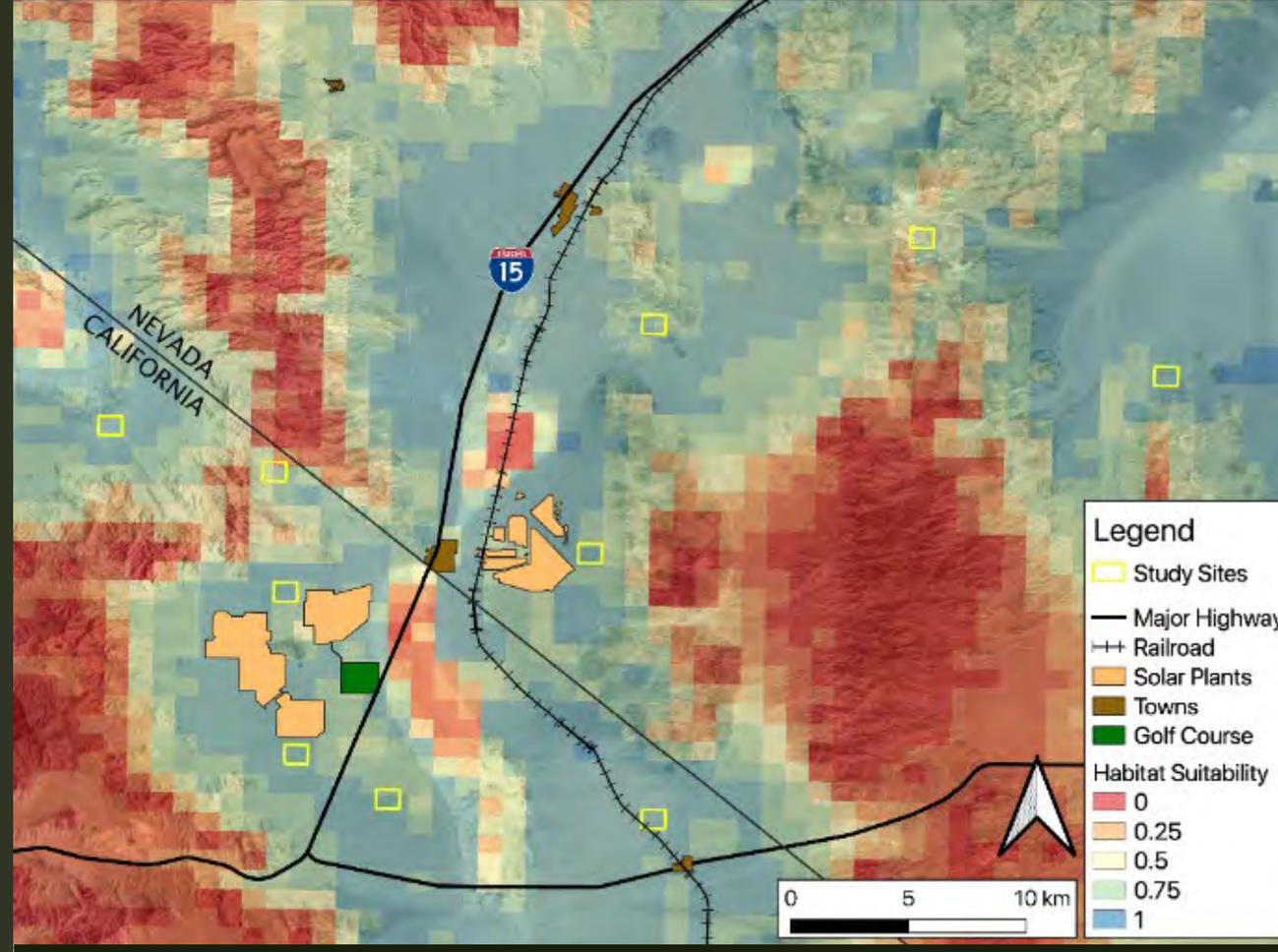
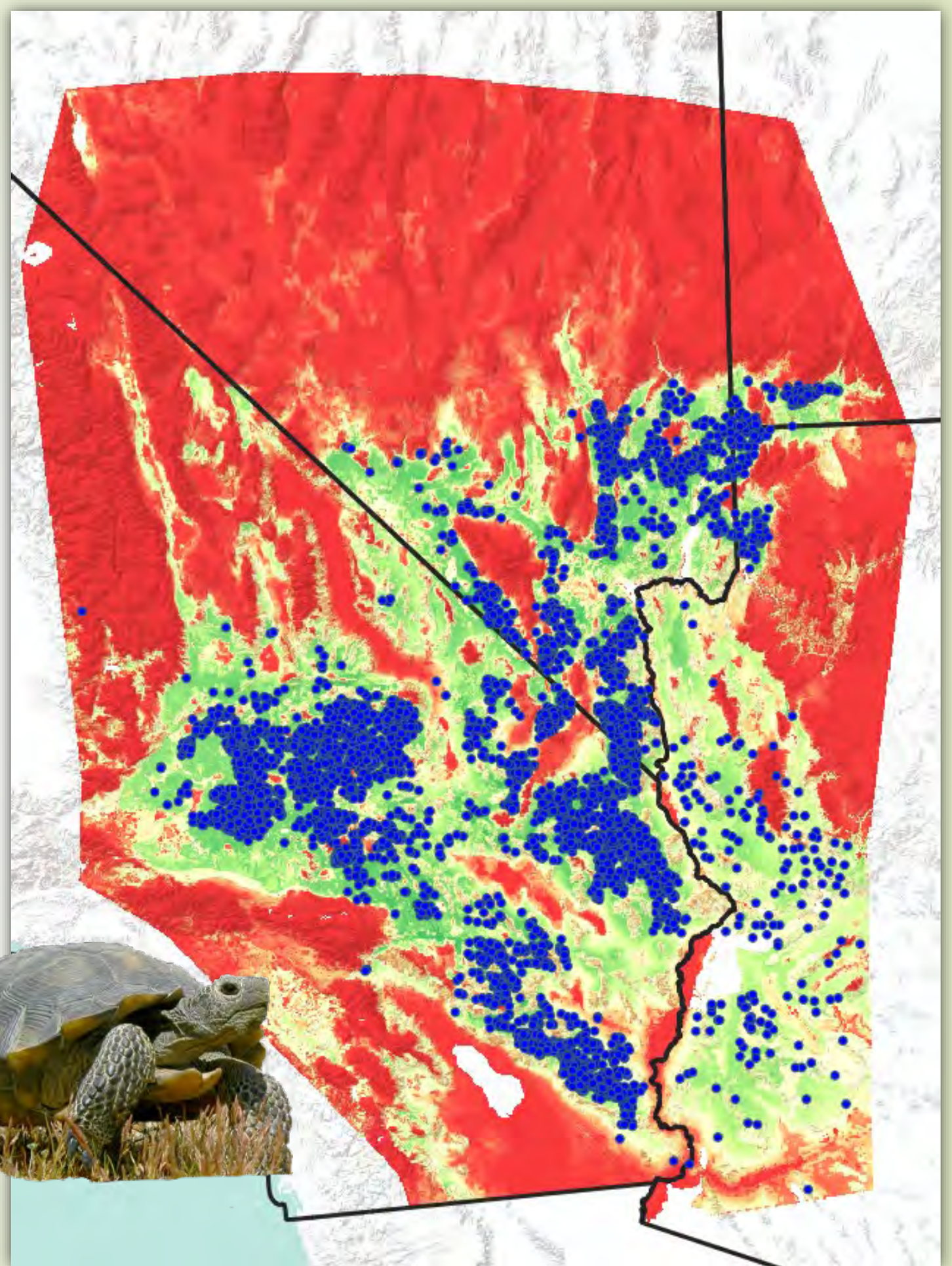
Landscape Connectivity



The impacts of land use and climate change on Mojave Desert tortoise structural genetics and corridor functionality

- *Phase I: Realized Desert Tortoise Habitat Model*
- Phase II: Desert Tortoise Landscape Corridor Functionality
- Phase III: Desert Tortoise Genetic Connectivity and Diversity
- Phase IV: Umbrella Assessment
- Phase V: Tech Transfer and Management Recommendations

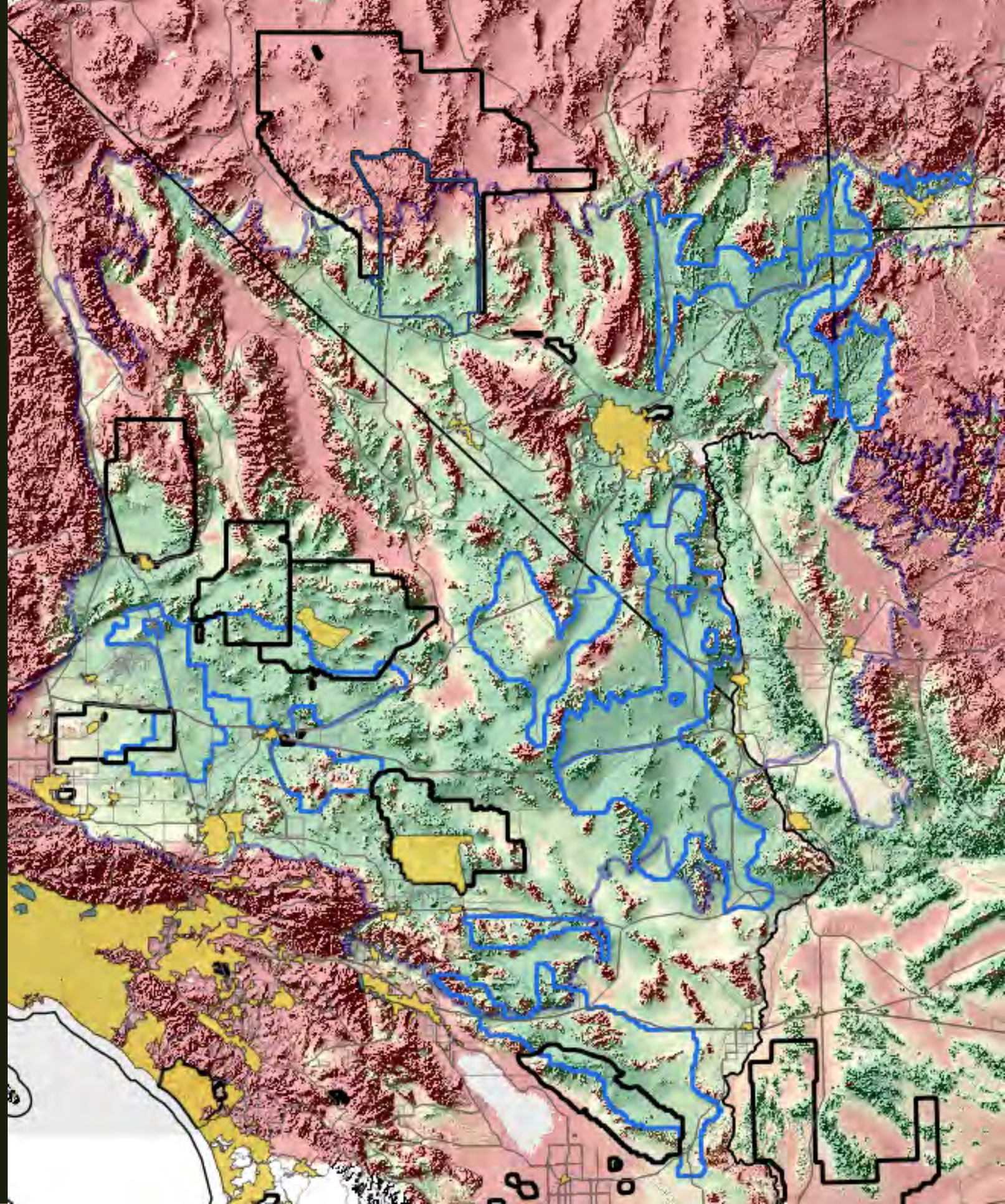
Desert Tortoise Distribution



Nussear et al. 2009

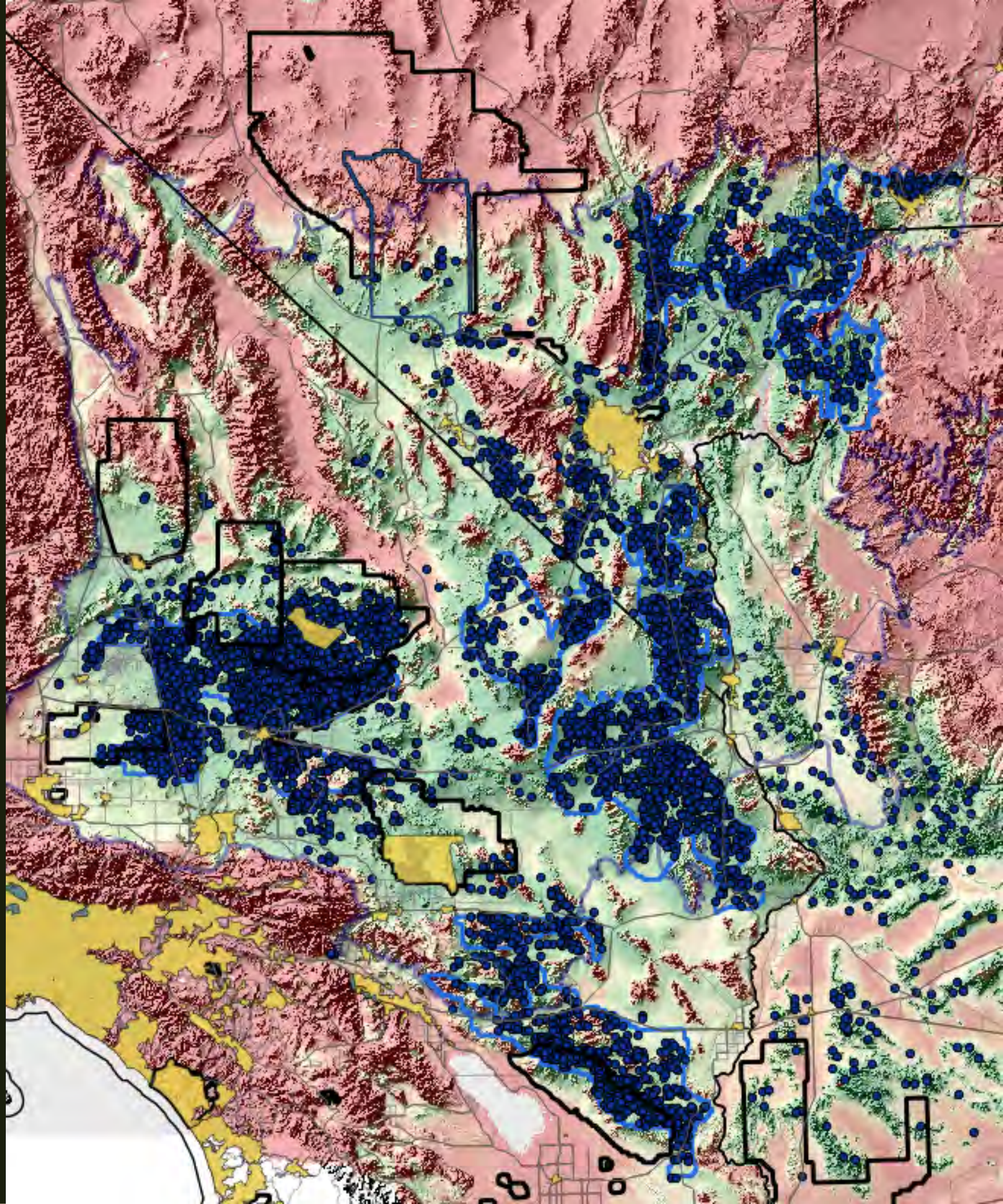
Regional Scale Habitat Modeling

- Adding "realism"
  - Urban Areas
  - Roadways
  - Disturbances
- Future Scenarios
  - Climate Change
  - Land Use Change



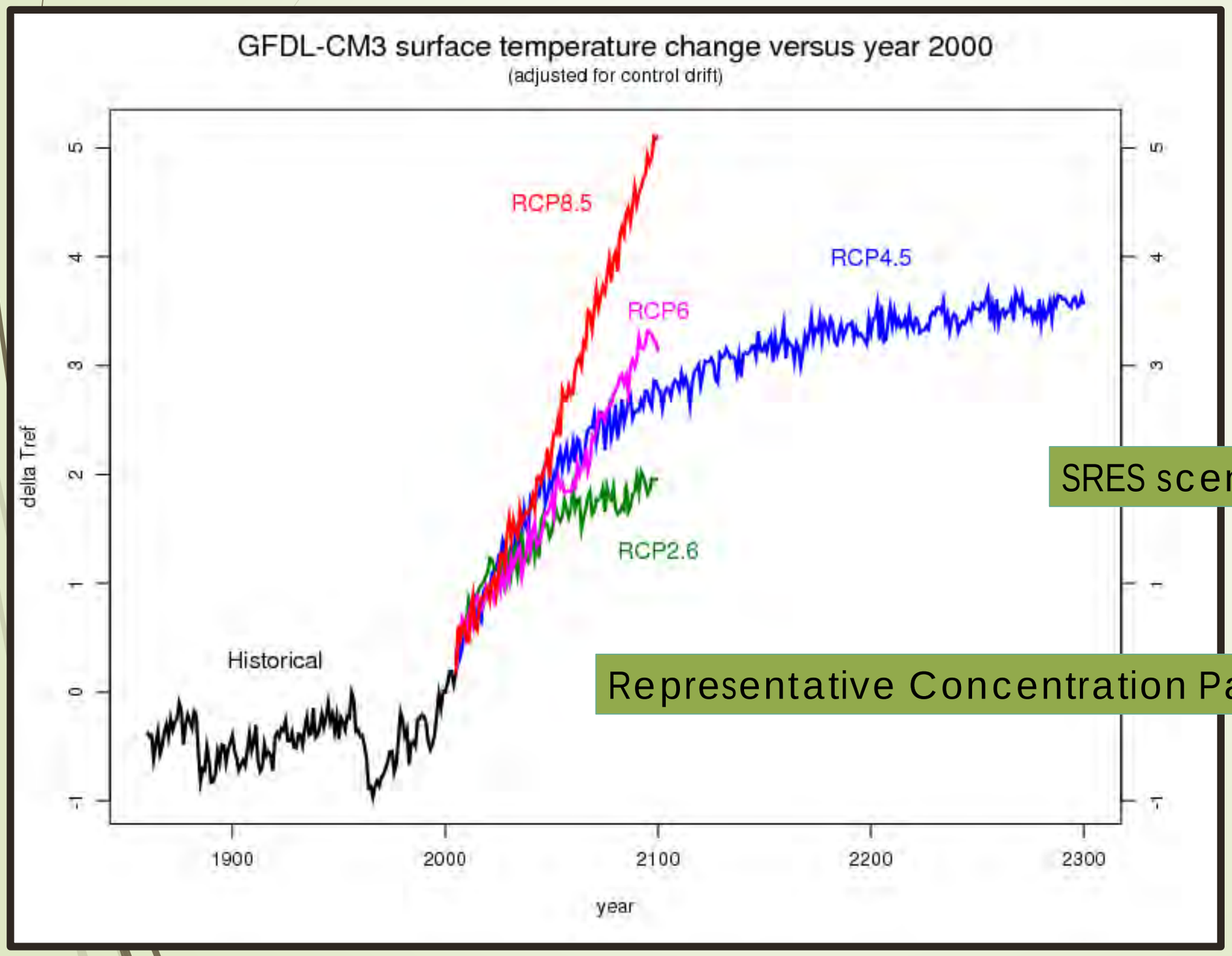
Regional Scale Habitat Modeling

- Where are our Data Gaps?
- Are they Important?



Future Climate Forecasts

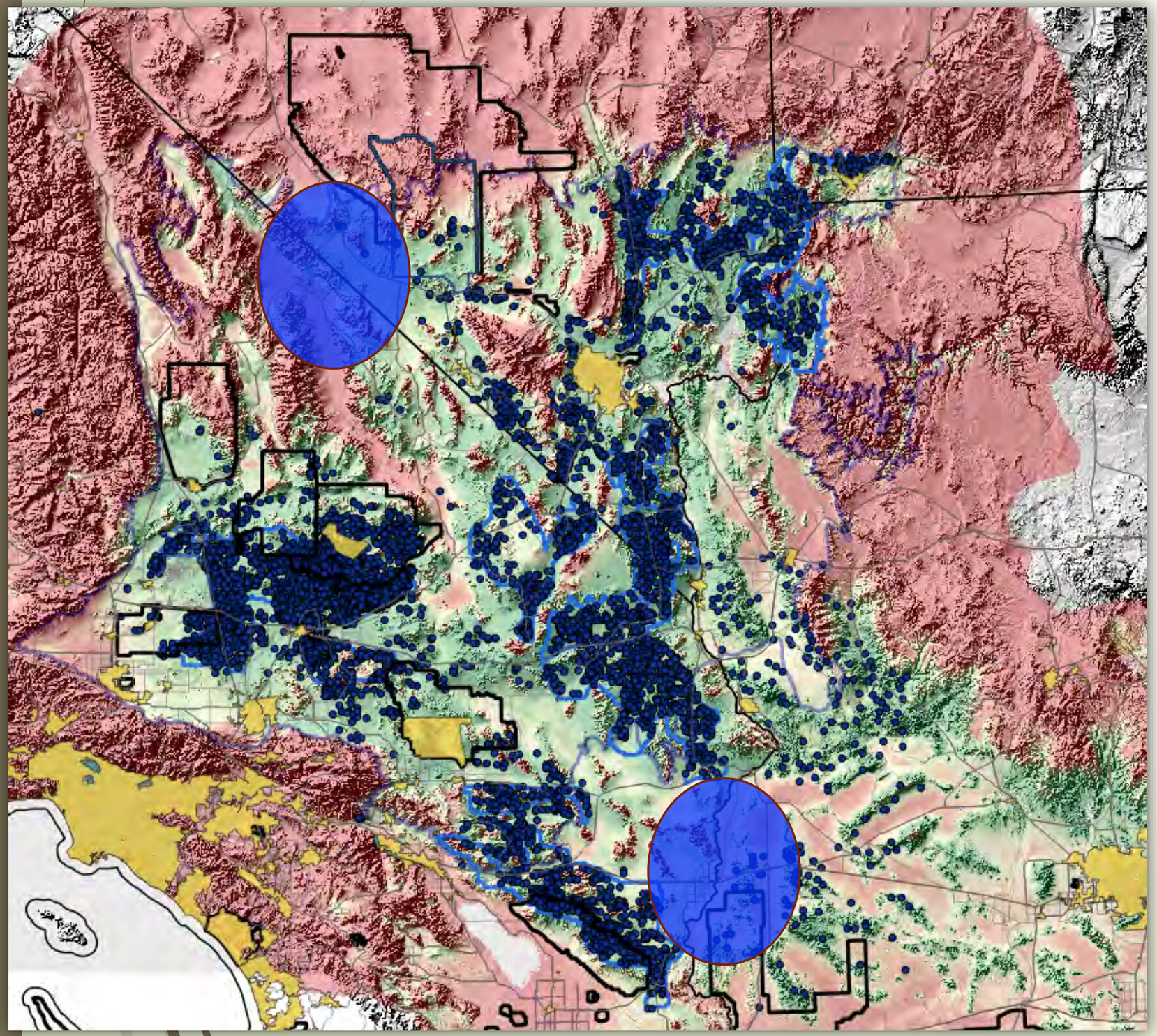
IPCC: CMIP3 (circa 2004) vs CMIP5 (circa 2011)

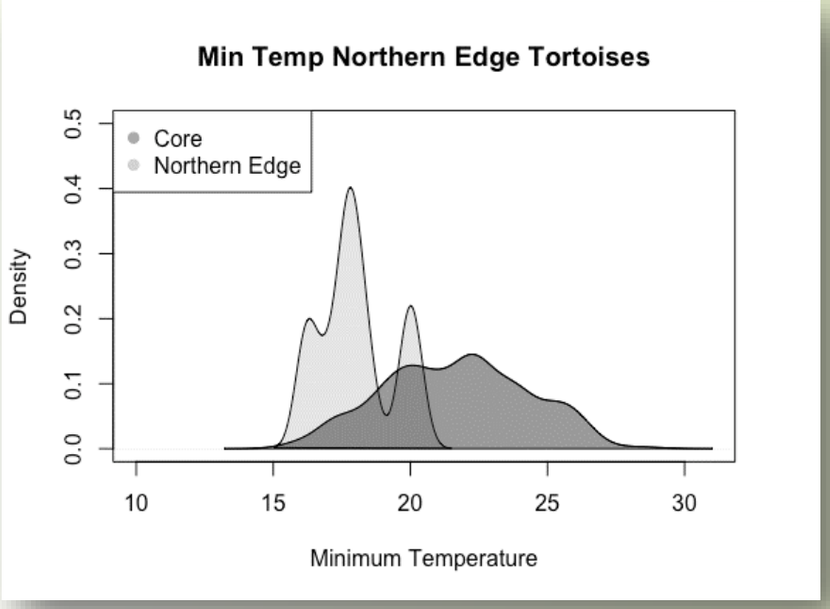


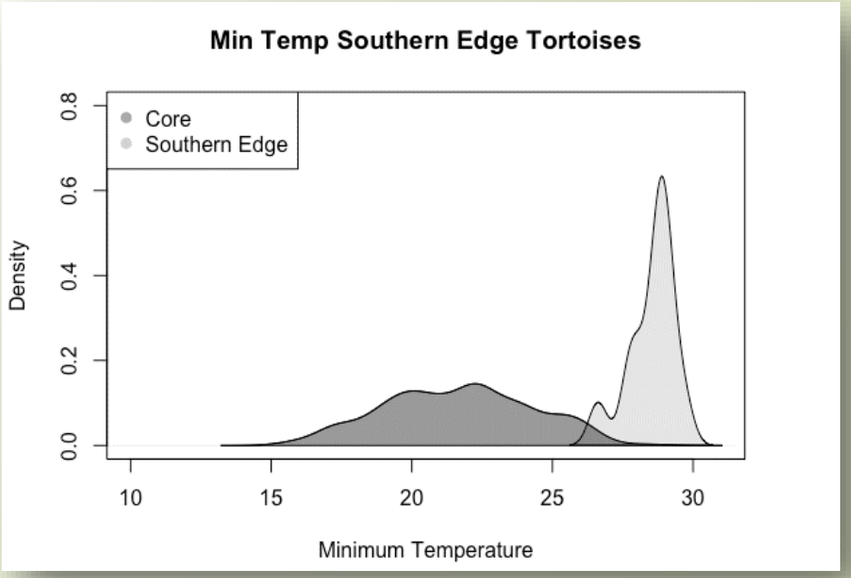
SRES scenarios (e.g. A2, B1,)

Representative Concentration Pathways (e.g. 2.6, 8.5)

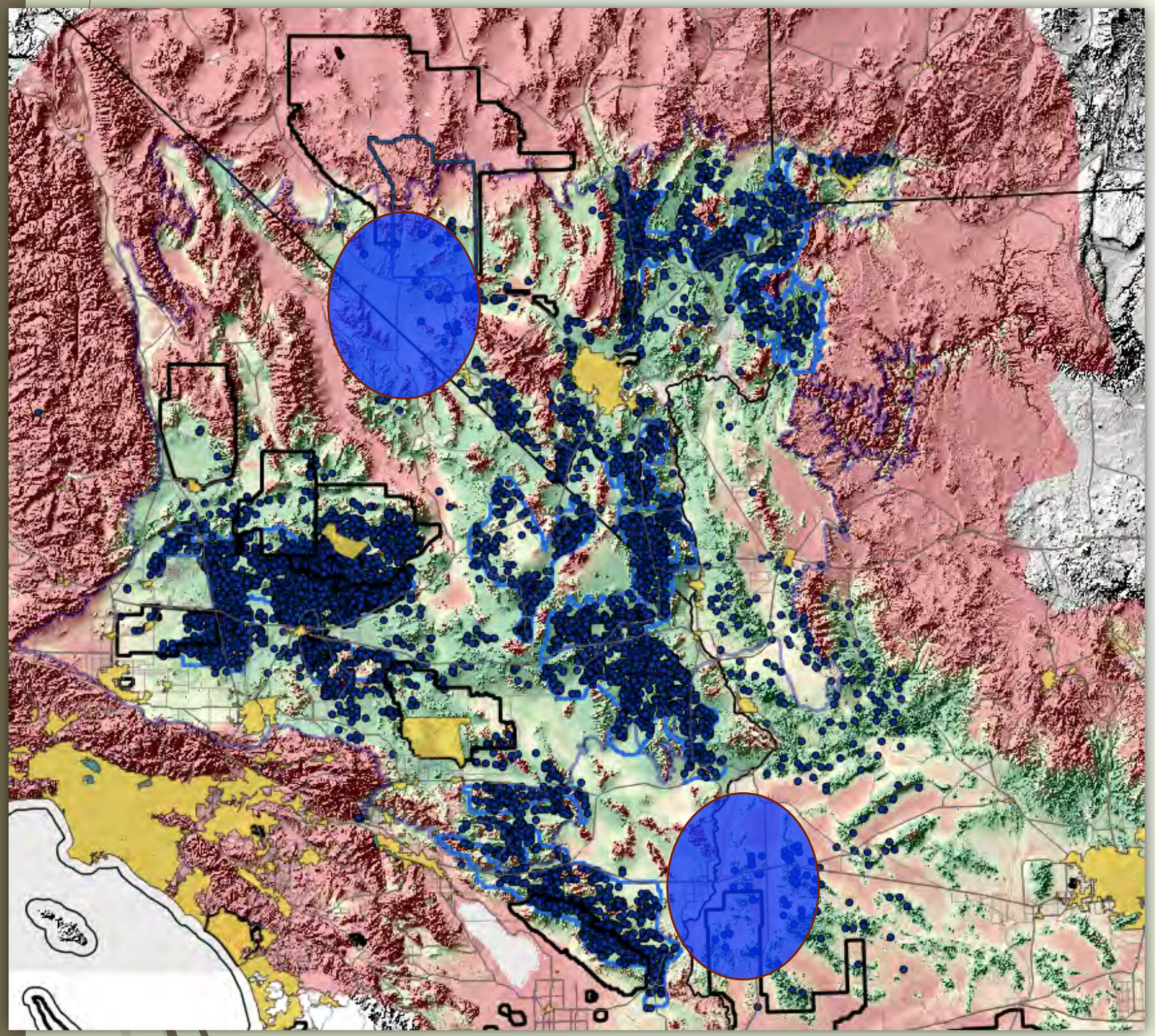
Regional Scale Habitat Modeling

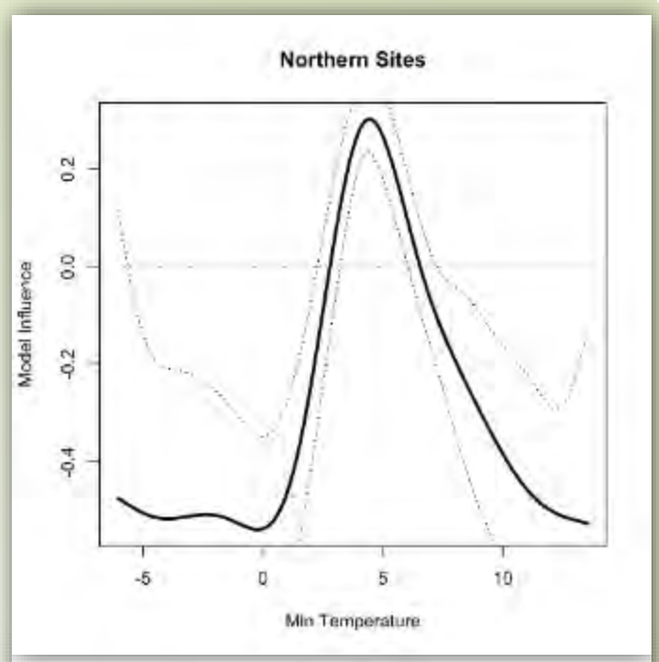


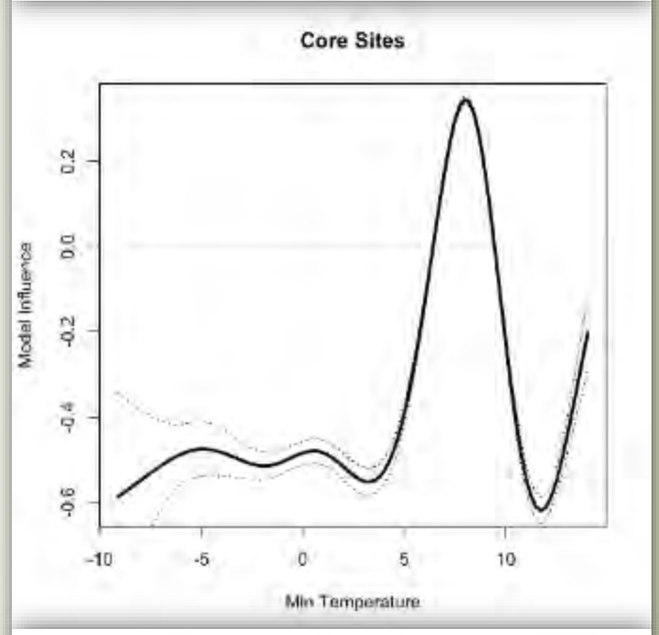


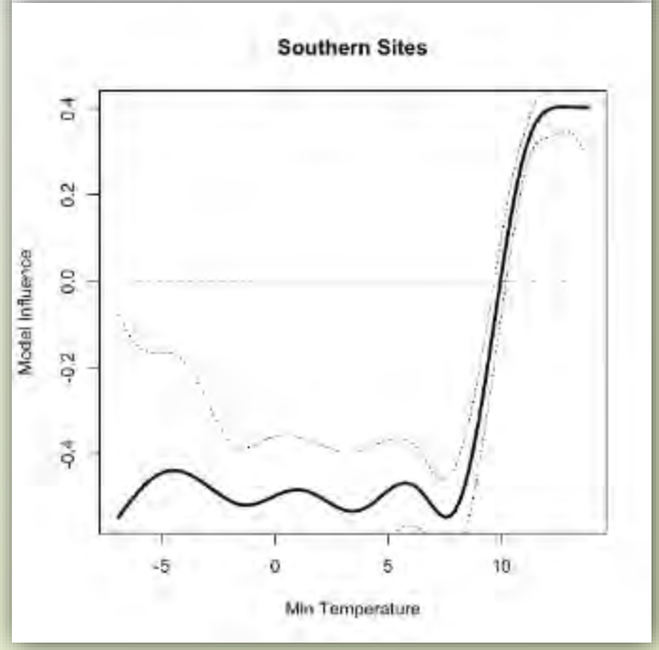


Regional Scale Habitat Modeling

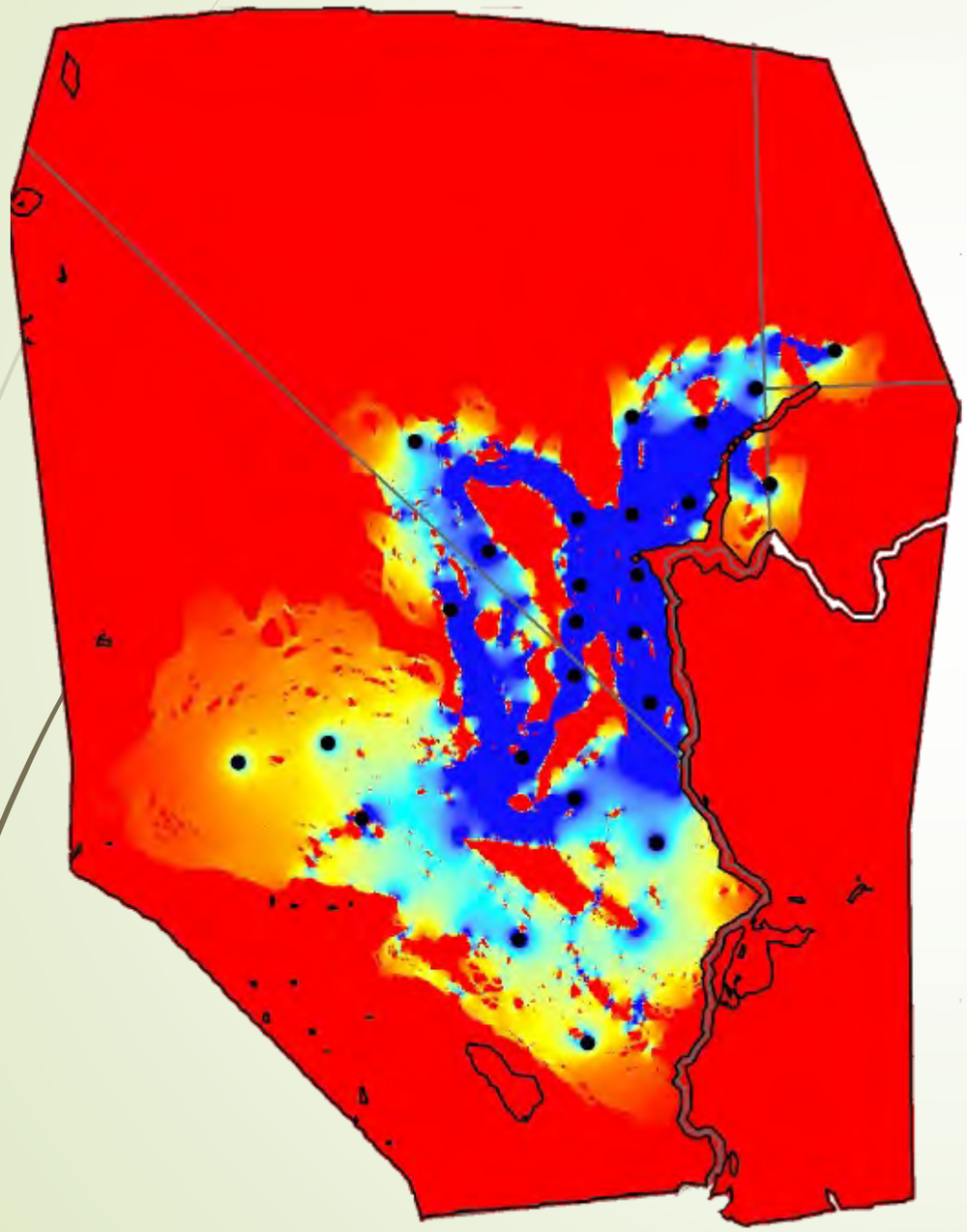


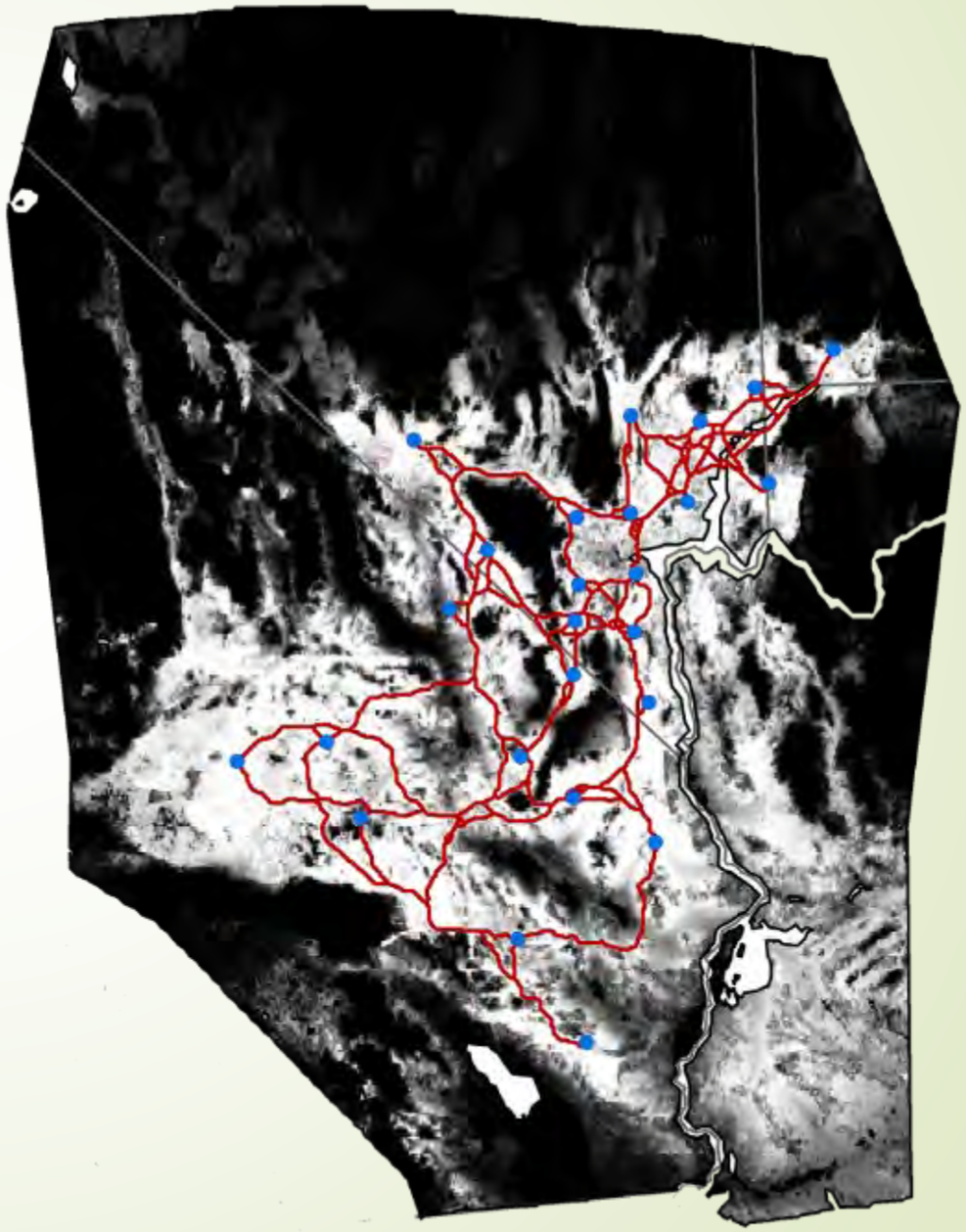






Landscape Genetics



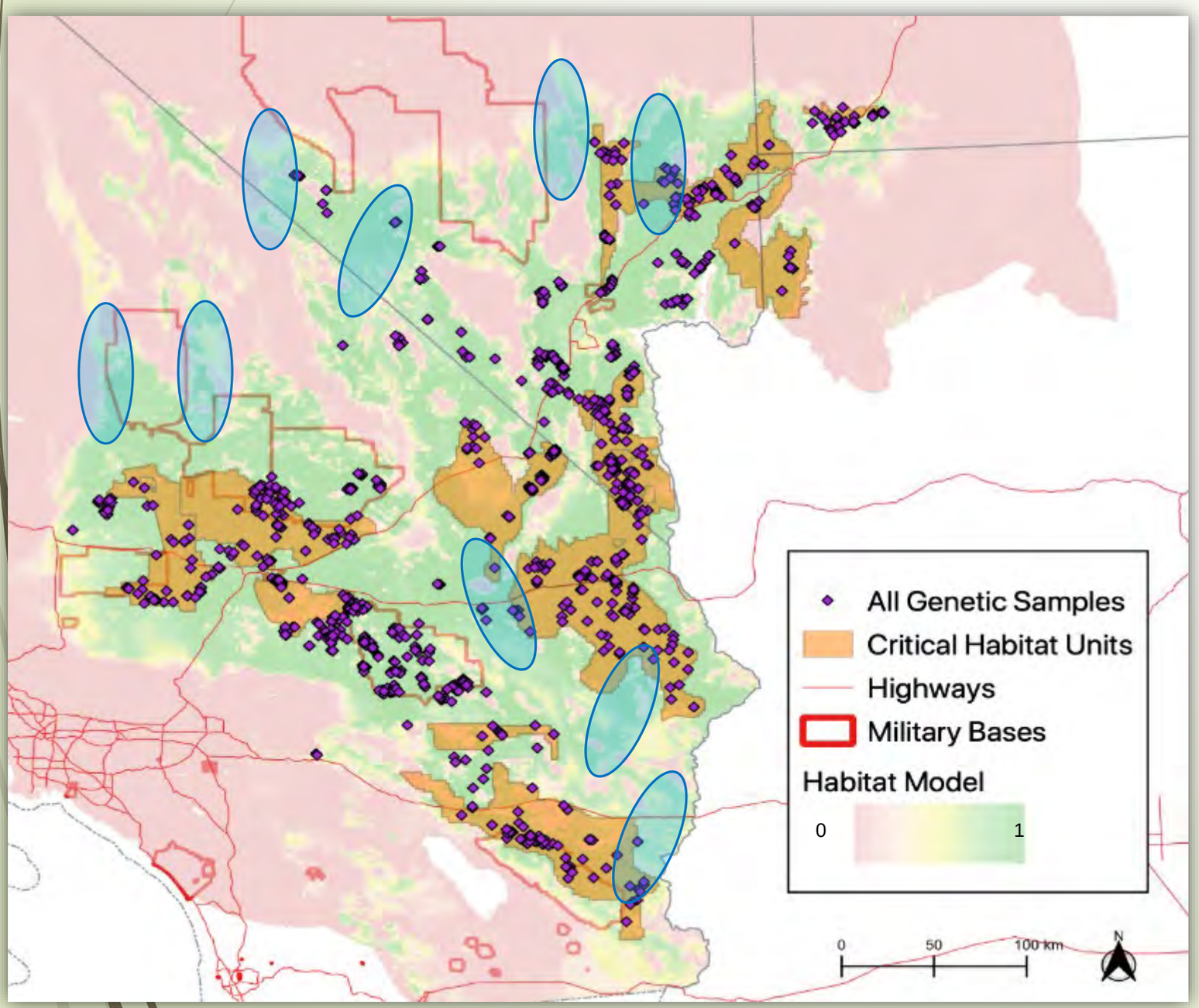


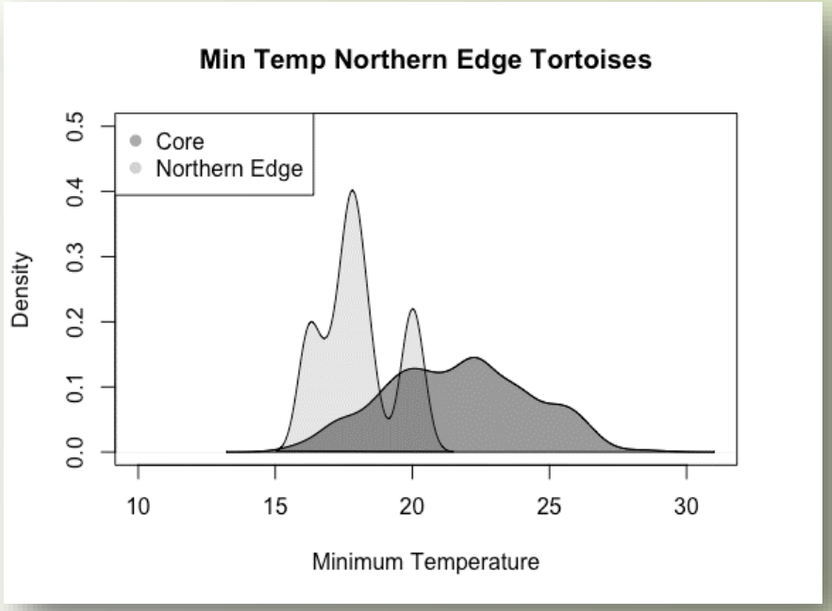
Hagerty et al. 2010

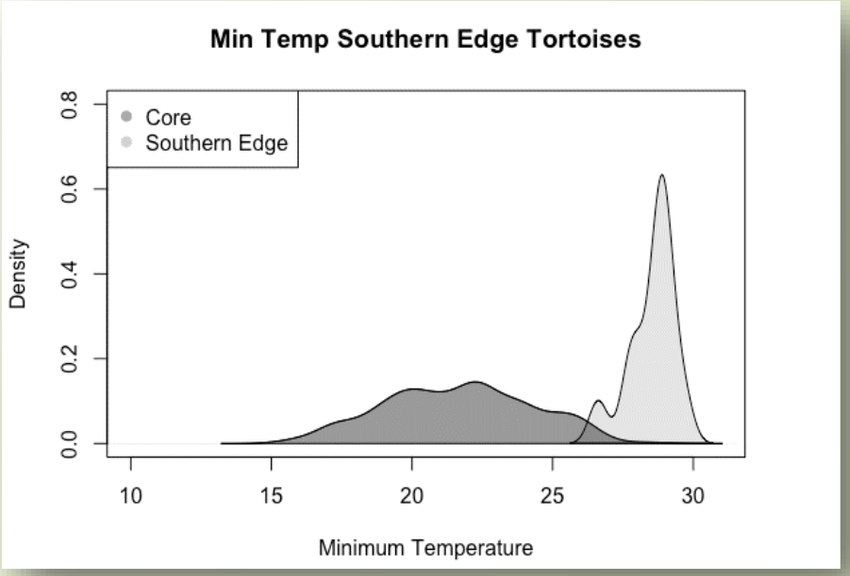
Regional Scale Landscape Genetics

Nussear, Heaton, Bassett, Boyle, Matocq, Esque, Vandergast

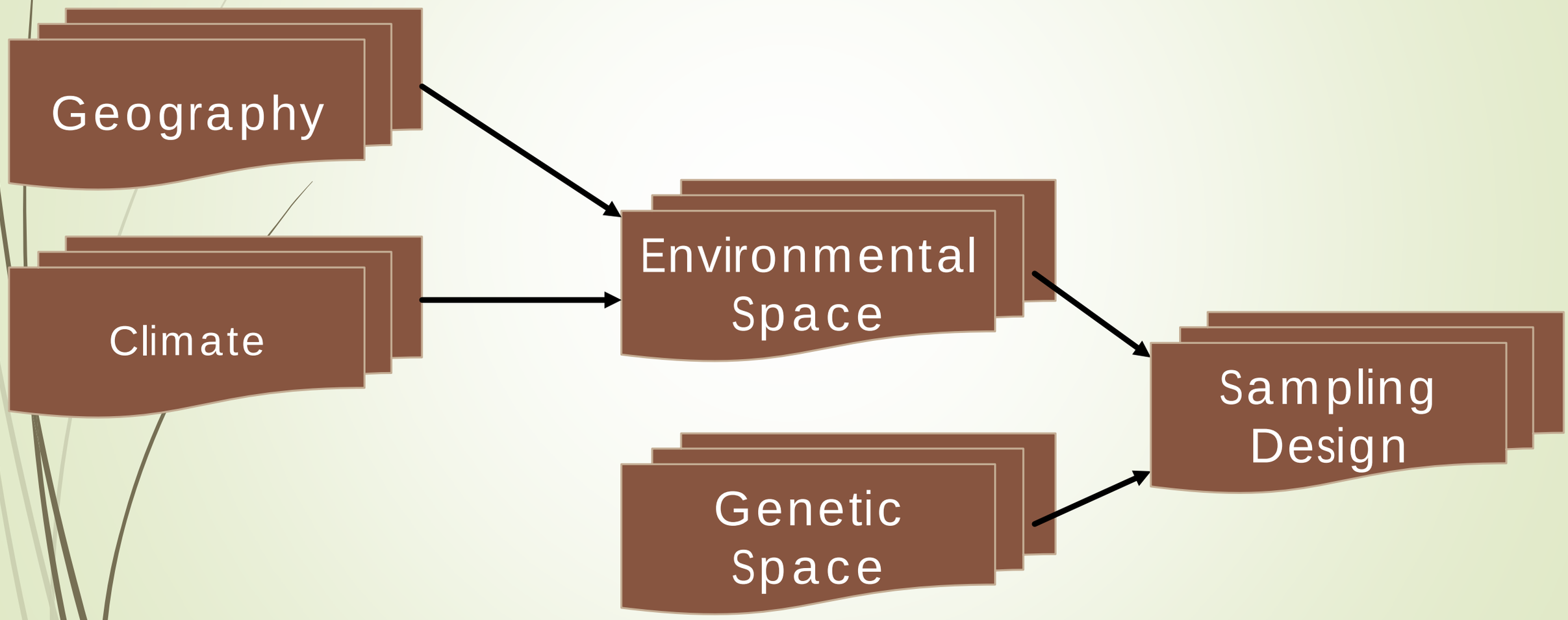
Anjana Parandhaman – PhD Student





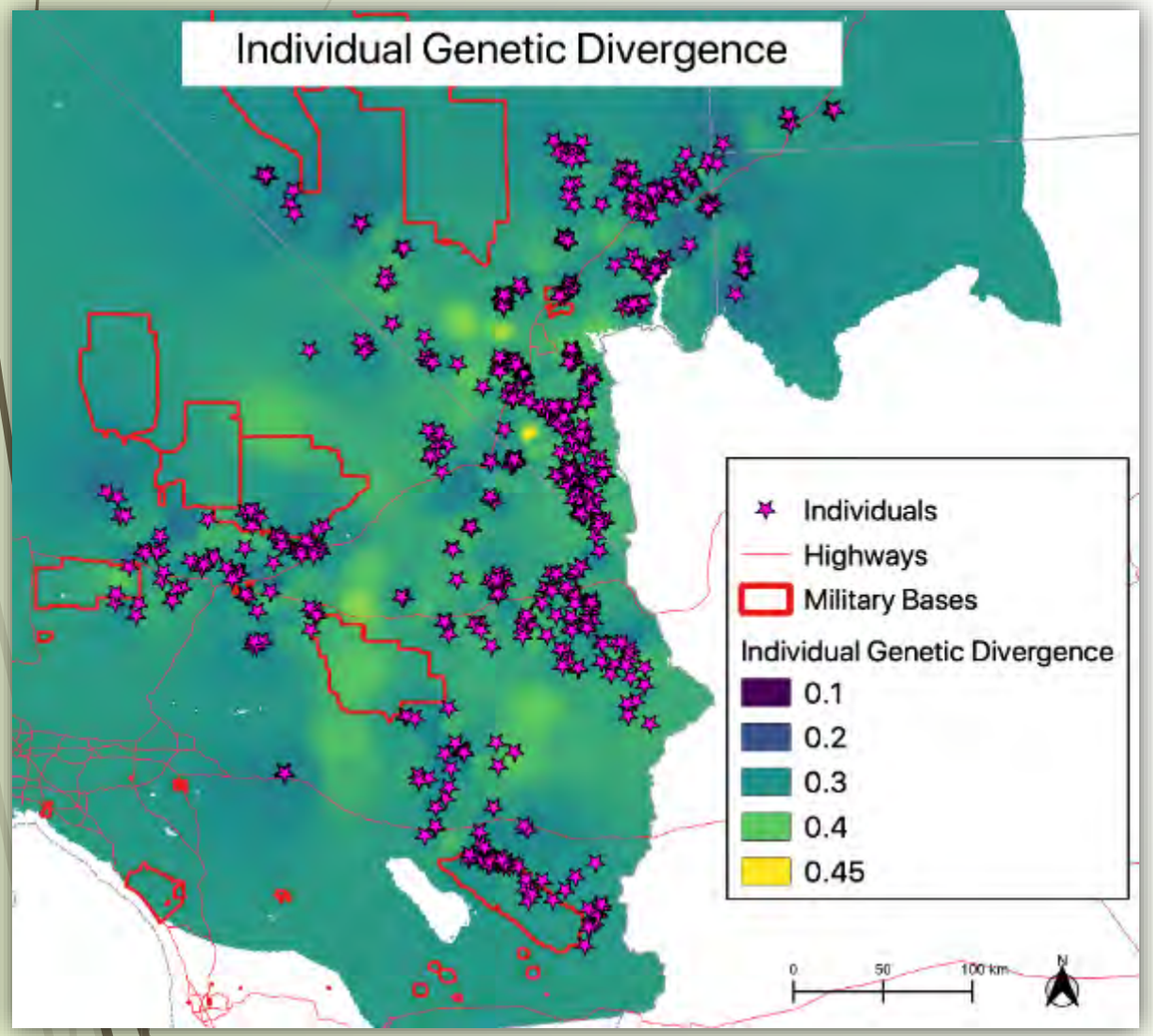


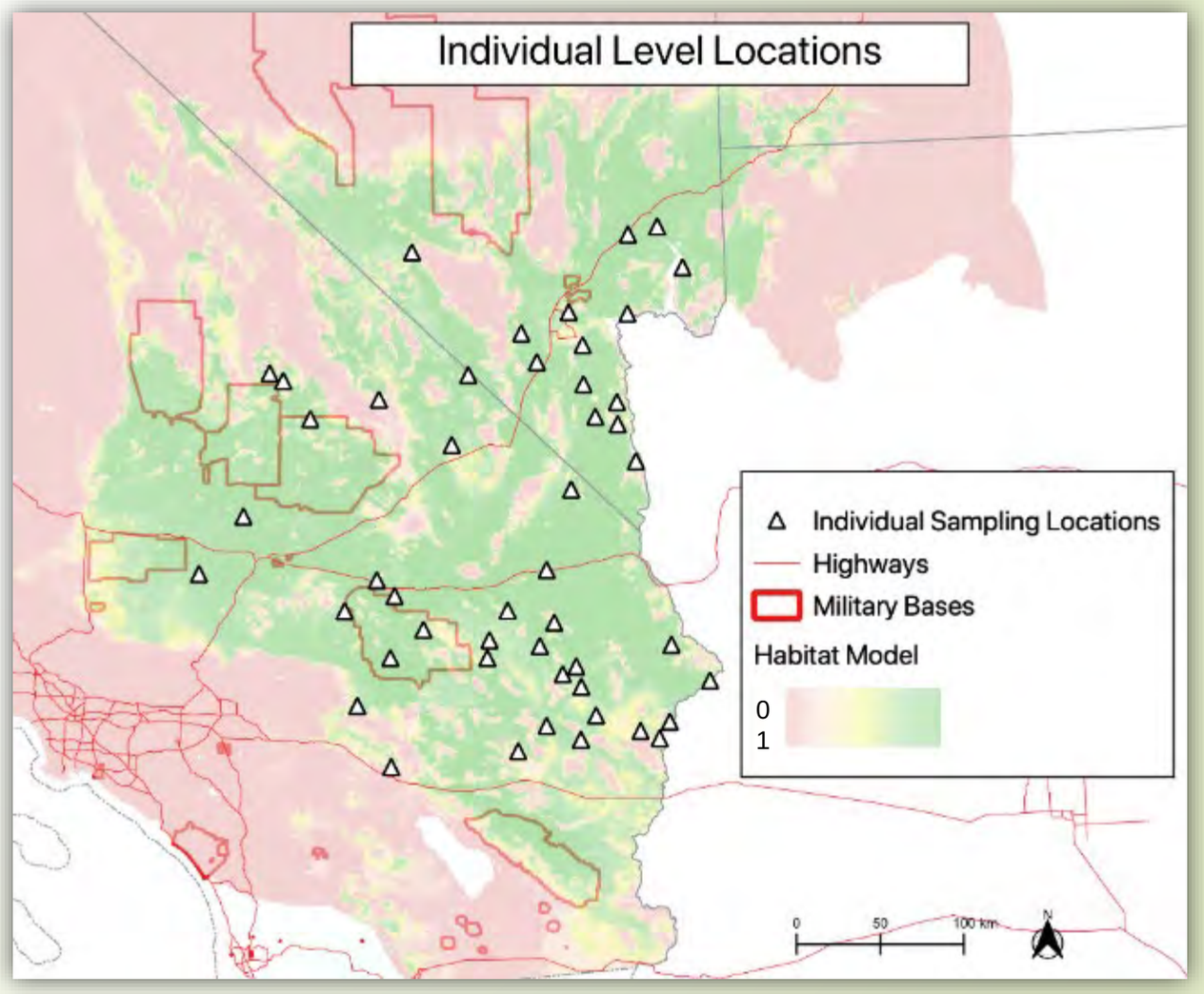
Prioritizing Genetic Sampling



Anjana Parandhaman – PhD Student

Sampling Prioritization





Habitat Connectivity?

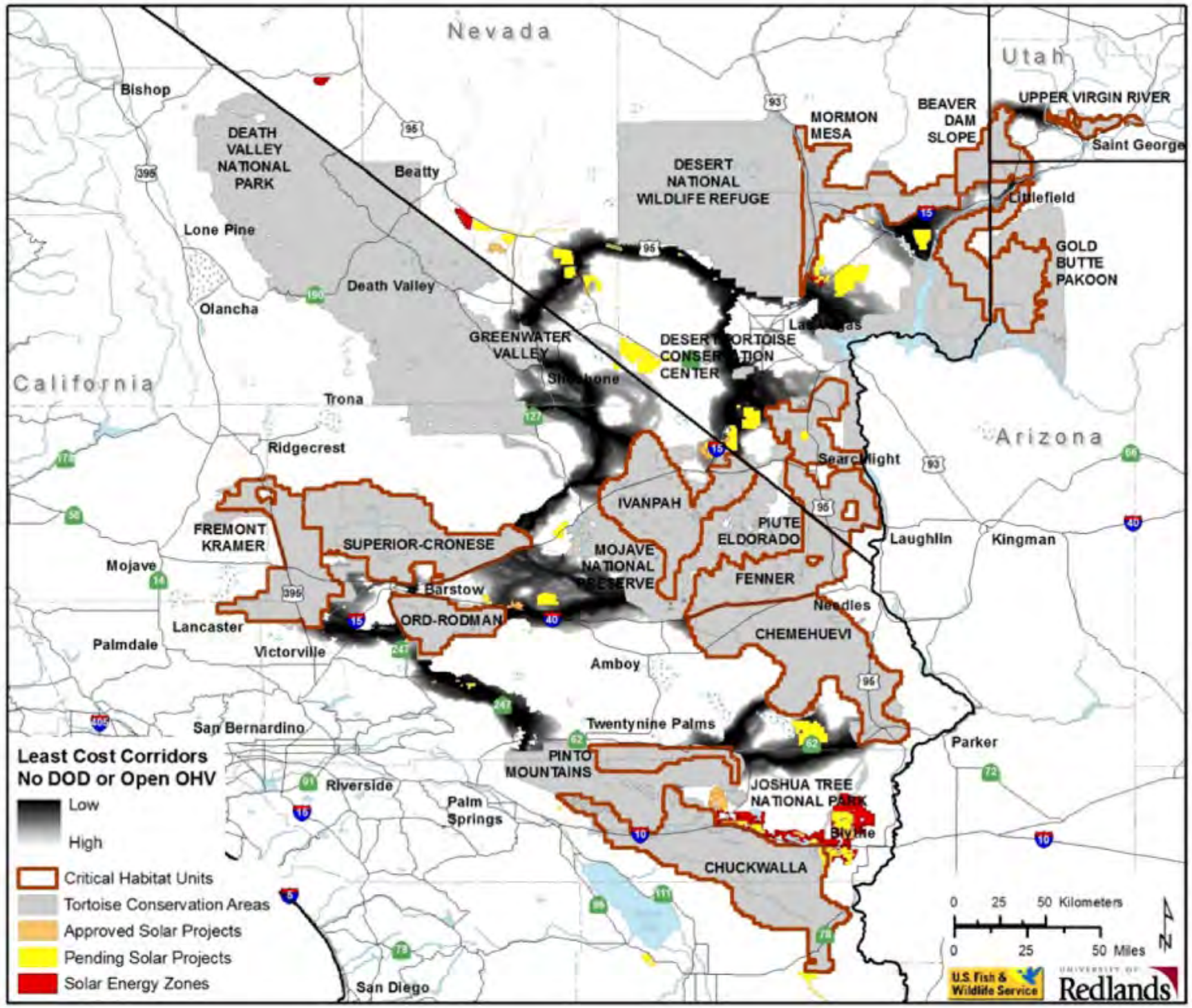
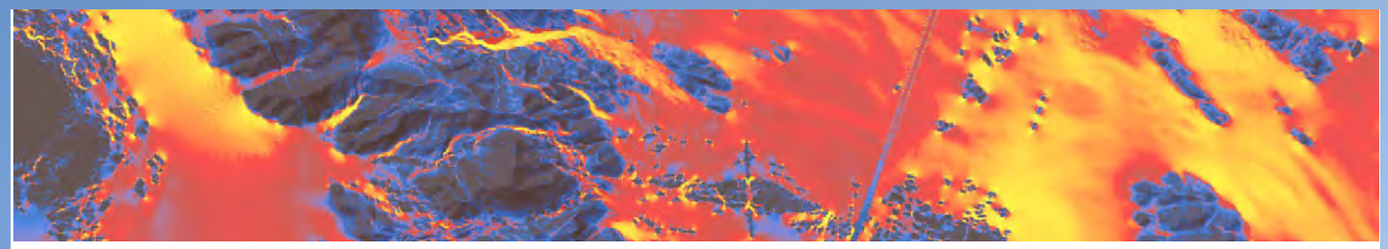


FIGURE 7. Least-cost corridors (Base2 model) between tortoise conservation areas (TCAs) relative to approved solar development projects, pending solar development projects, and solar energy zones. Each corridor includes the lowest 1% cost-distance paths between TCAs, where the relative cost to tortoises increases from black to white. White patterns within TCAs are private inholdings within federal lands.

Averill-Murray et al. 2009

Habitat Connectivity?

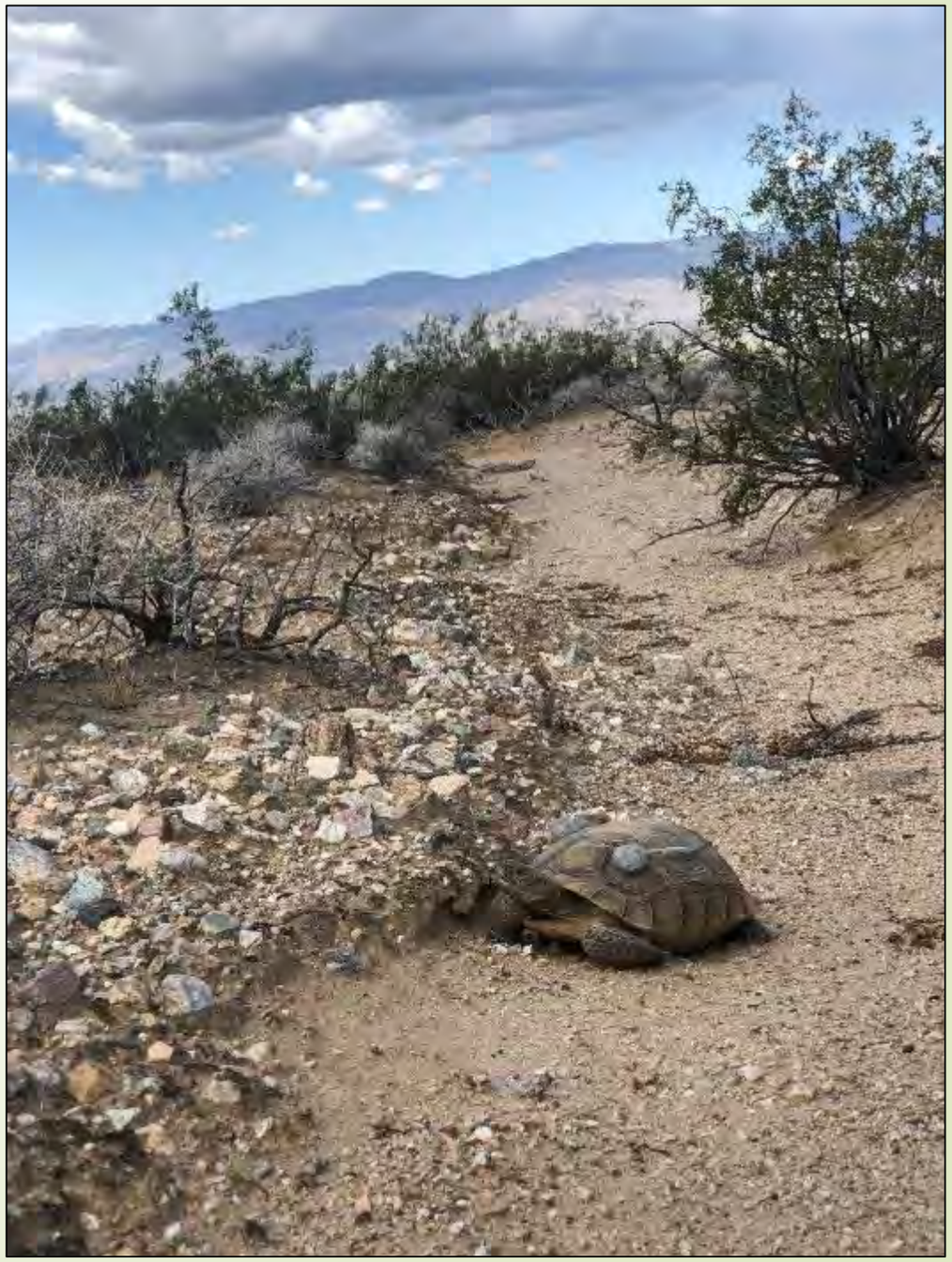


Gray et al. 2019

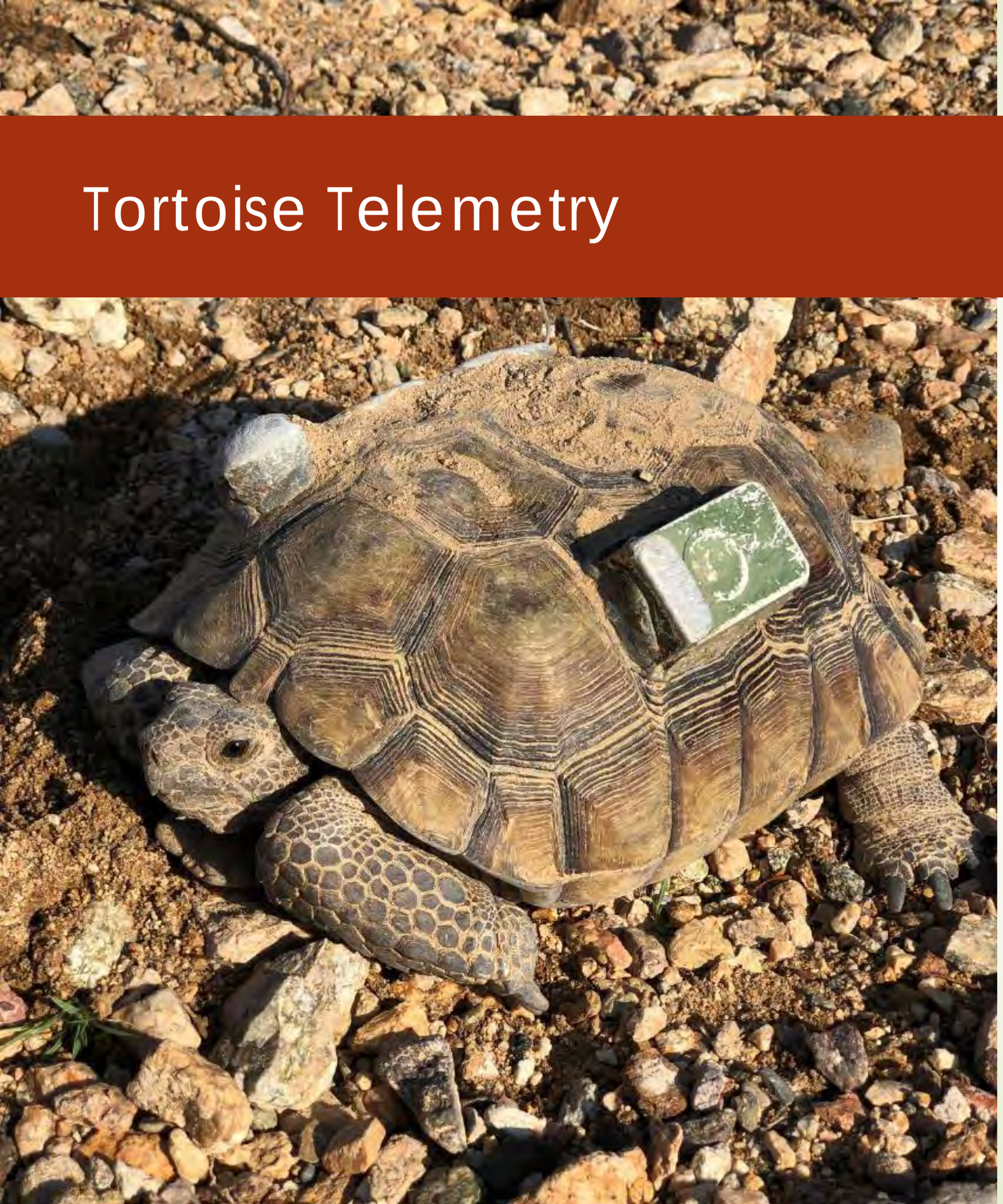
Understanding Habitat Selection

Steve Hromada – PhD Student

- How are tortoises selecting habitat?
  - Where do they move?
  - Where do they choose to burrow?
- How do anthropogenic disturbances influence these choices?



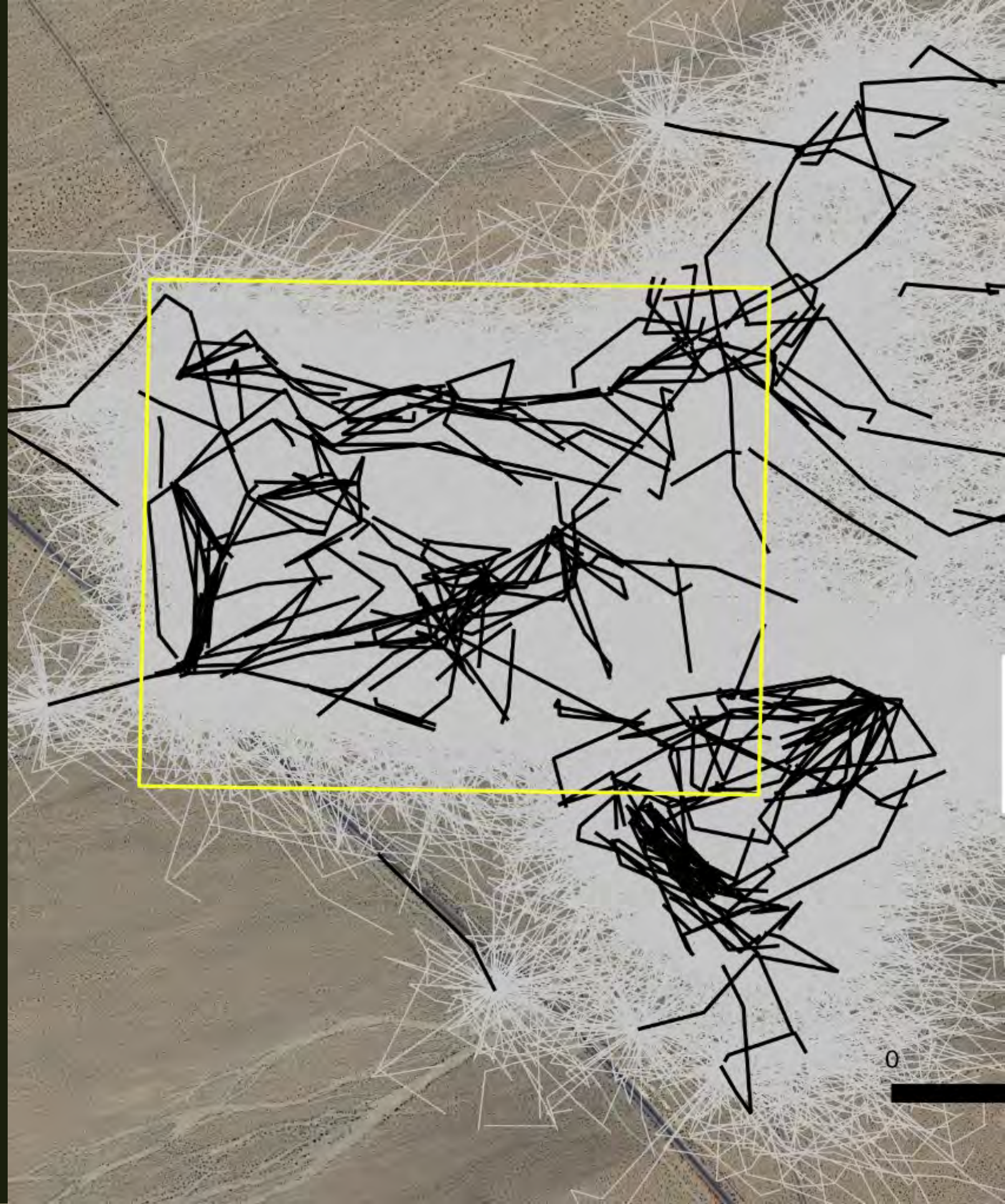
Tortoise Telemetry



- Adult tortoises (n=130) have a VHF radio and GPS logger
- Tracked once a month to swap GPS loggers
- GPS loggers record a point every hour April-October
- ~4,500 points/tortoise (568,479 total: 2015-2018)

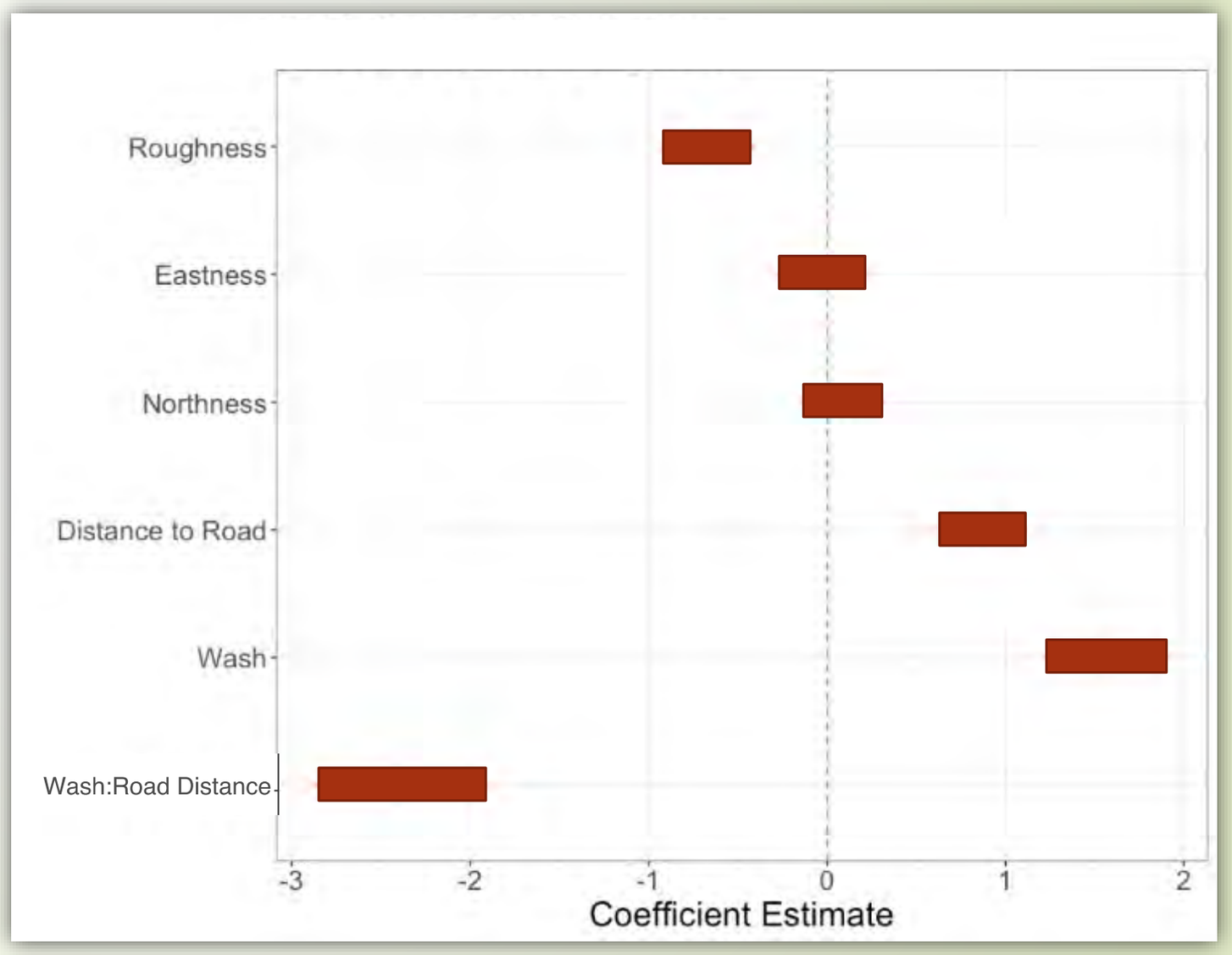
Habitat Use

- Fine Scale Habitat Use - Movement
- Compare with Random Pathways



Path Selection - Results

- Tortoises select against roughness, and road proximity
- Positive selection for washes, but not when a road is present
- No selection on aspect variables



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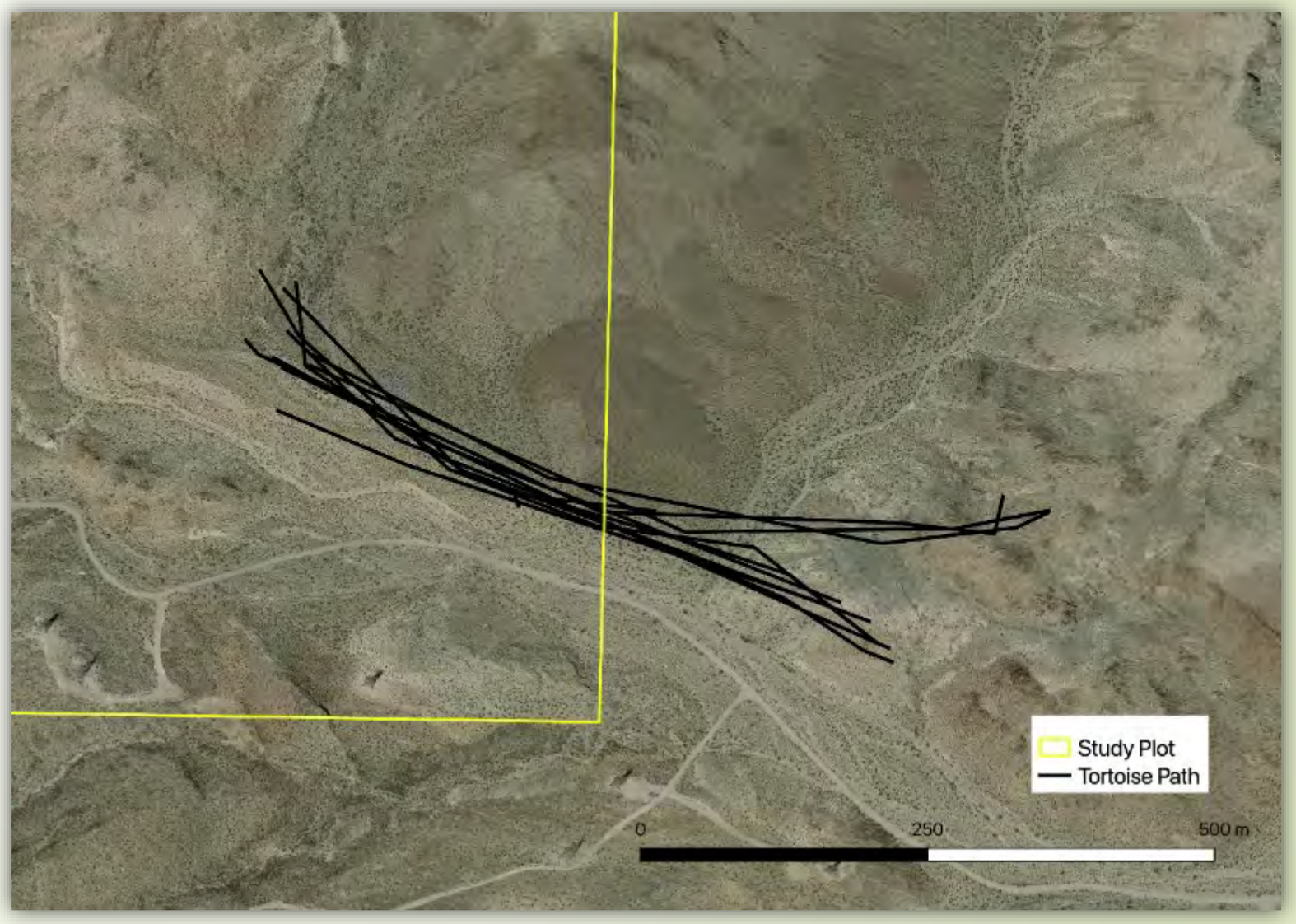
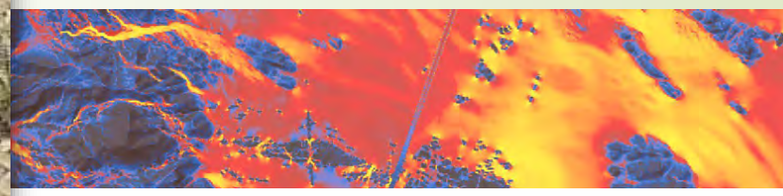
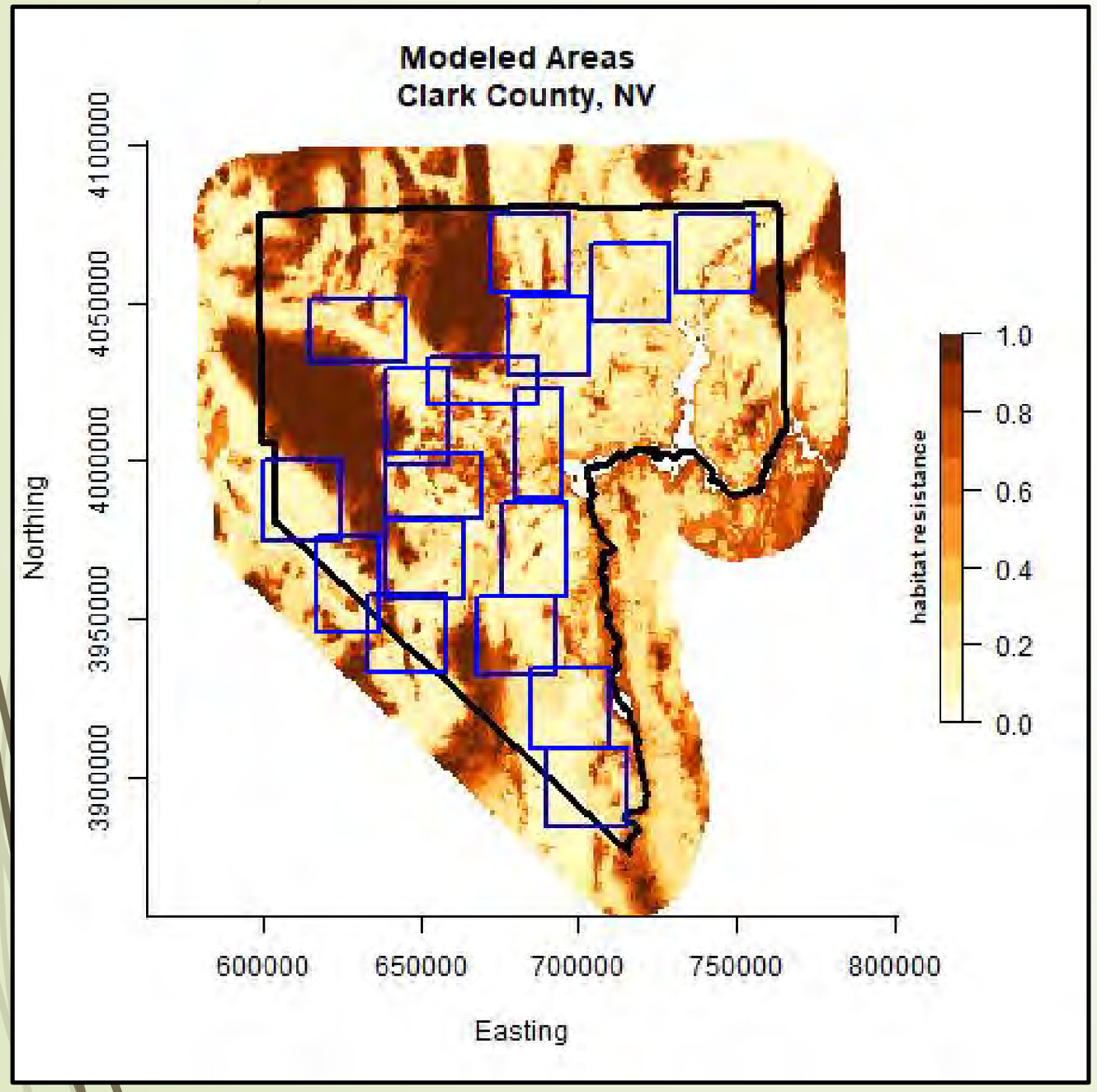


Quantifying Connectivity



The Future



- Modeling habitat and connectivity
  - Climate Forecasts/scenarios
  - Future land development and use scenarios
- Integrate habitat, genetic structure, land use to identify potentially important areas of connectivity