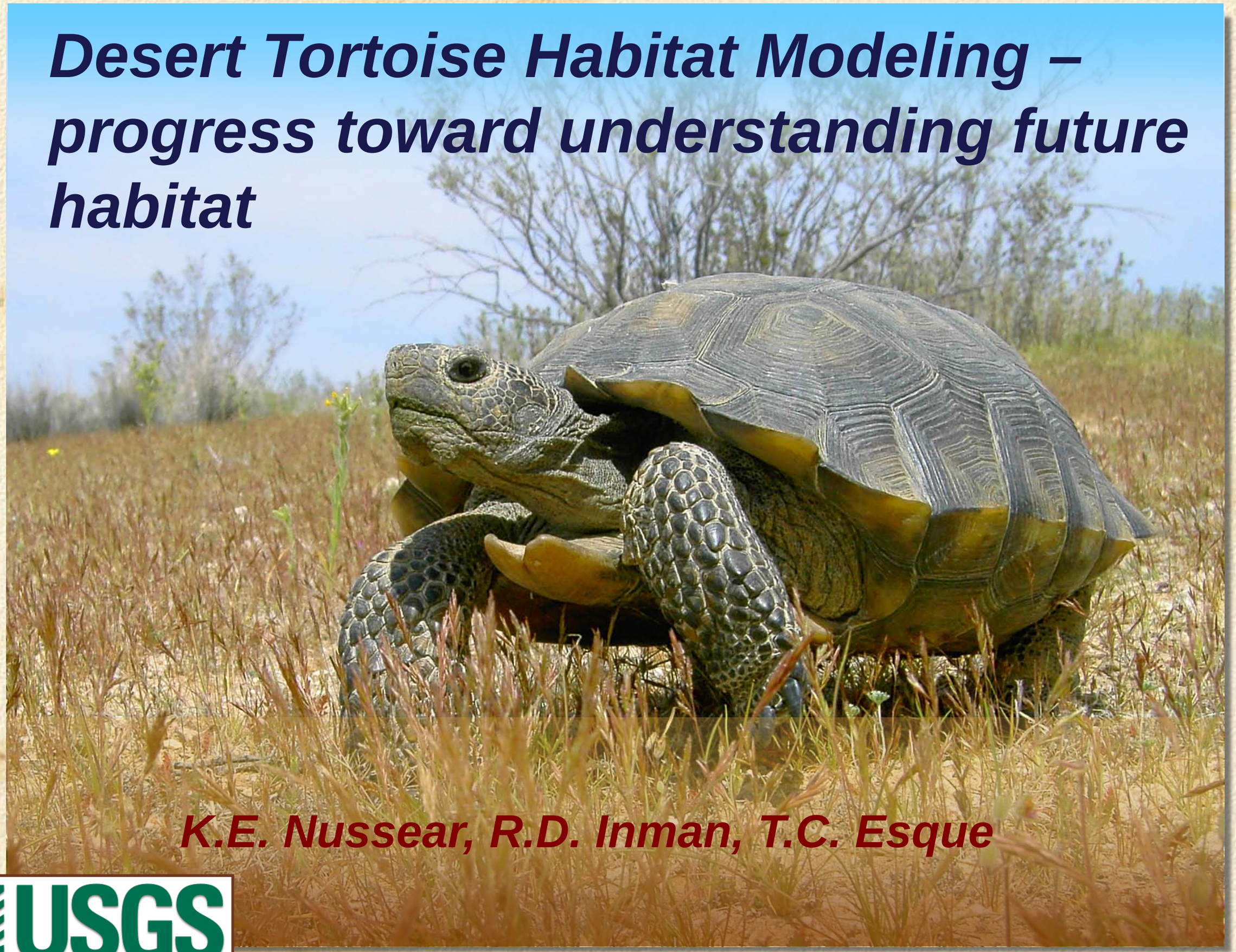
Desert Tortoise Habitat Modeling – progress toward understanding future habitat



K.E. Nussear, R.D. Inman, T.C. Esque

USGS
science for a changing world

USGS Habitat Model - 2009

Hagerty et al. 2010
Landscape genetics

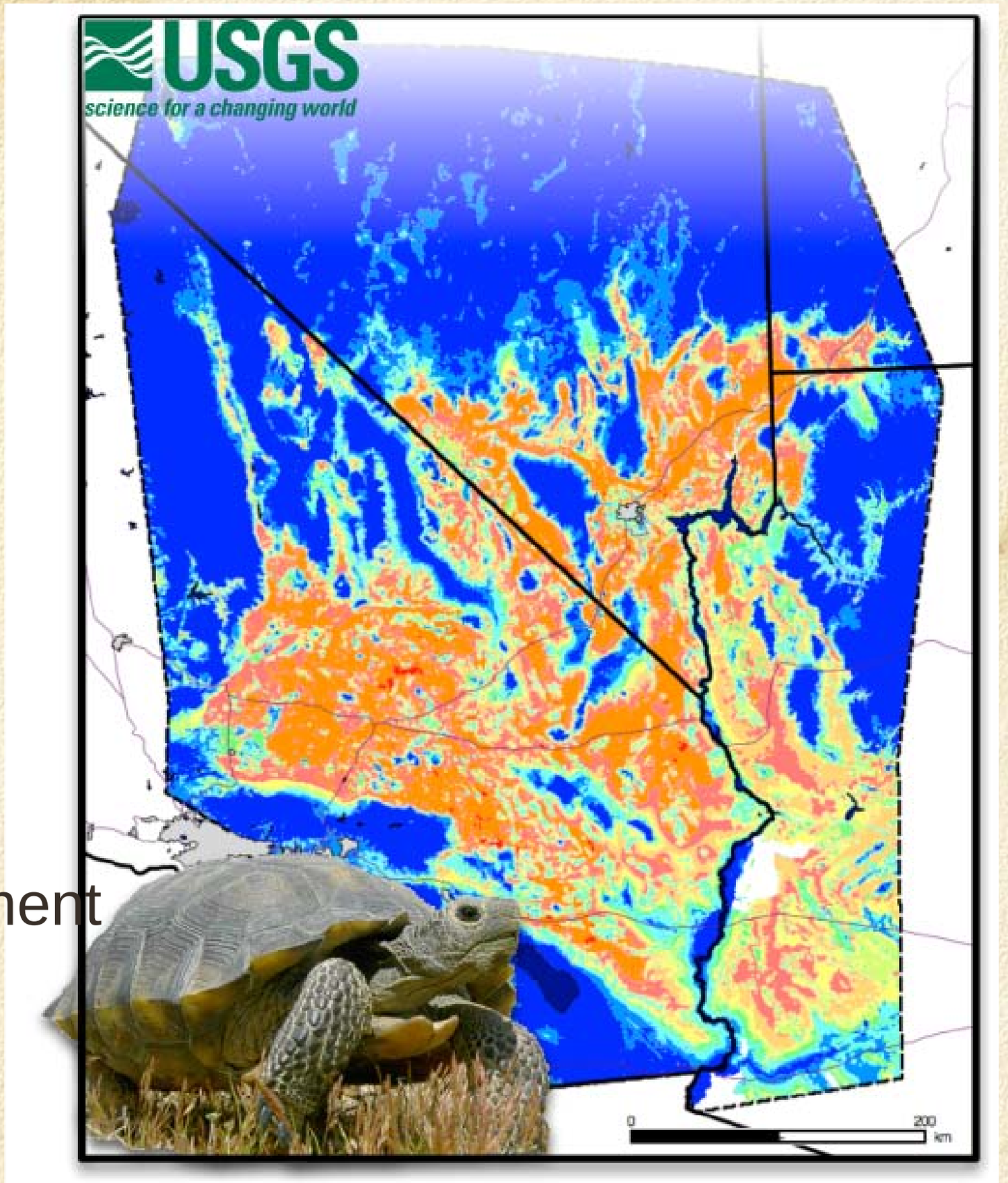
DT Recovery Plan 2011
Recovery planning

Averill Murray et al. 2012
Decision support

Averill Murray et al. 2013
Connectivity assessment

BLM REAs - 2012

DRECP - Currently



Adapted from Nussear et al. 2009

Habitat Description

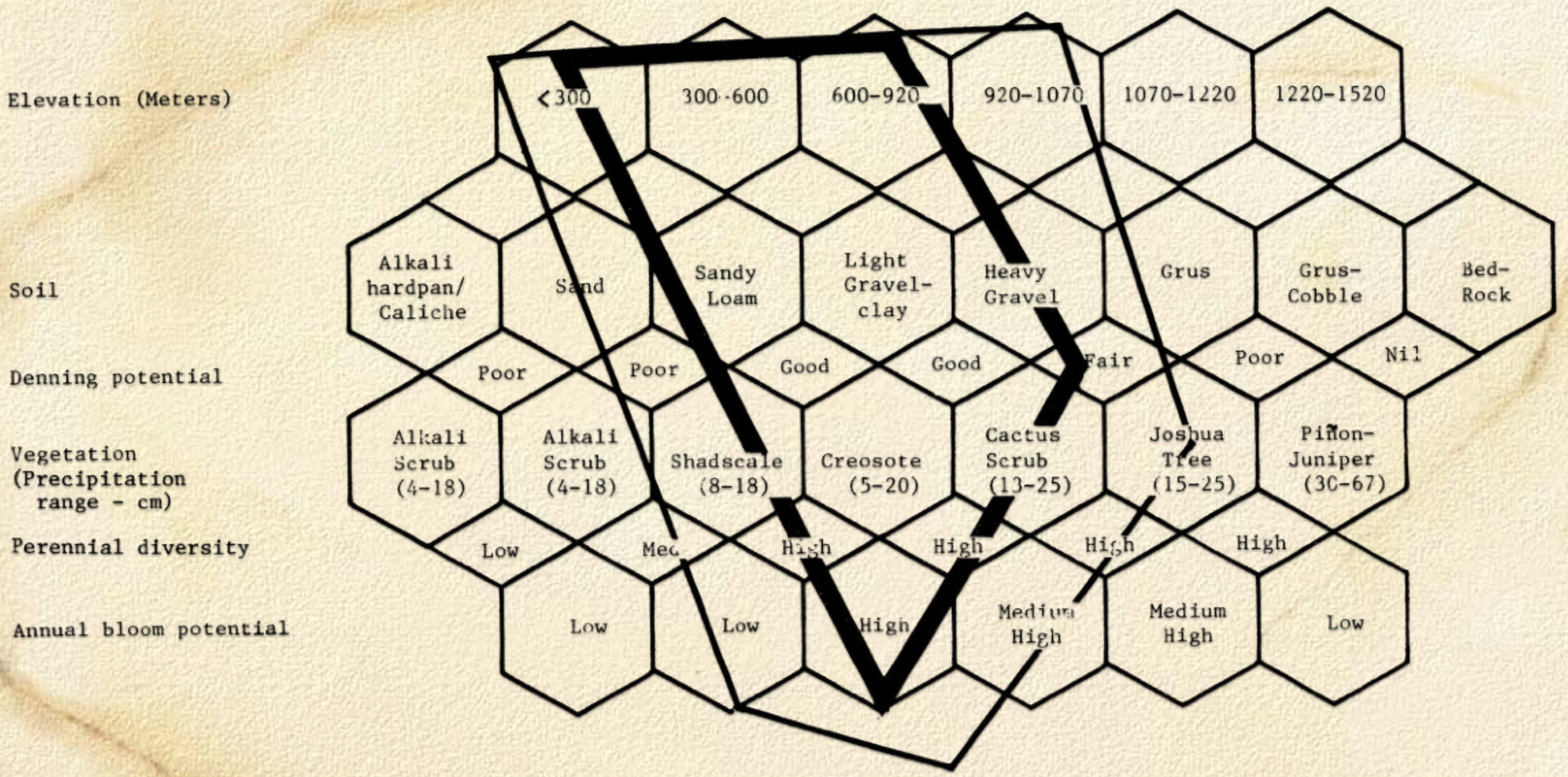
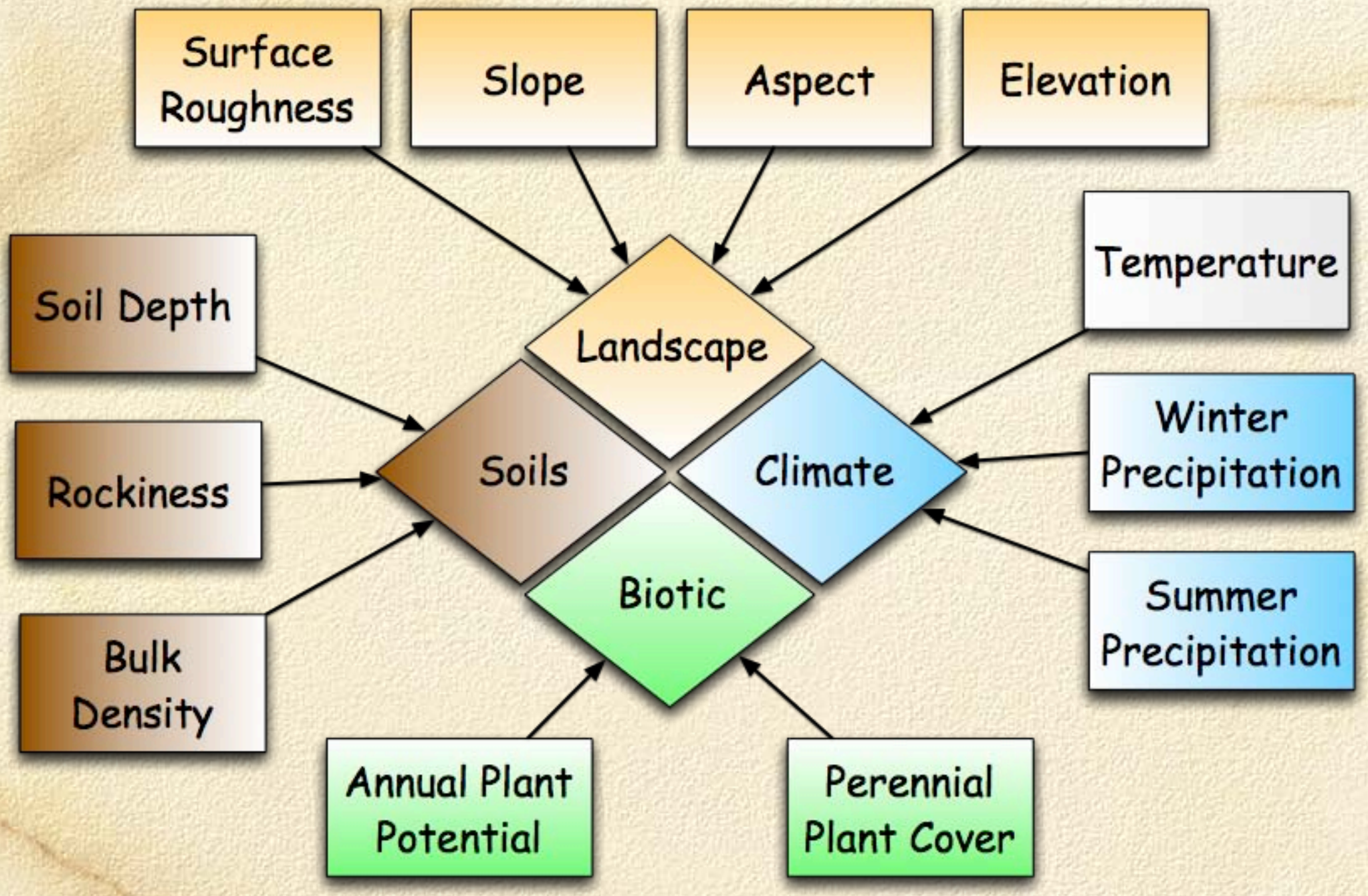


Fig. 5. Environmental matrix for the Desert tortoise in California. Thick line indicates the preferred range, thin line the estimated potential range.

Luckenbach 1991

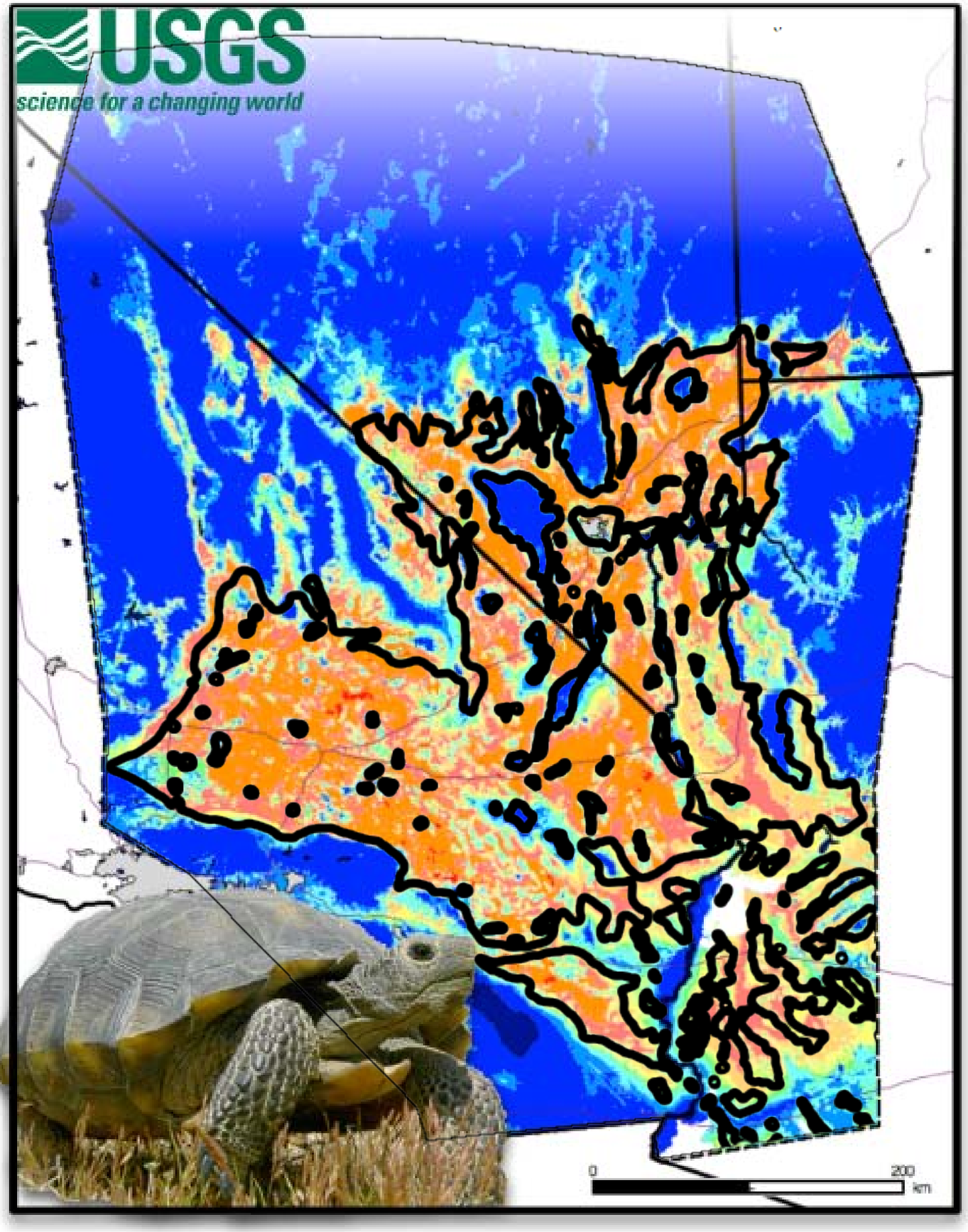
Habitat/Distribution Model



Blainey et al. 2007, Wallace and Thomas 2008, Wallace et al. 2008

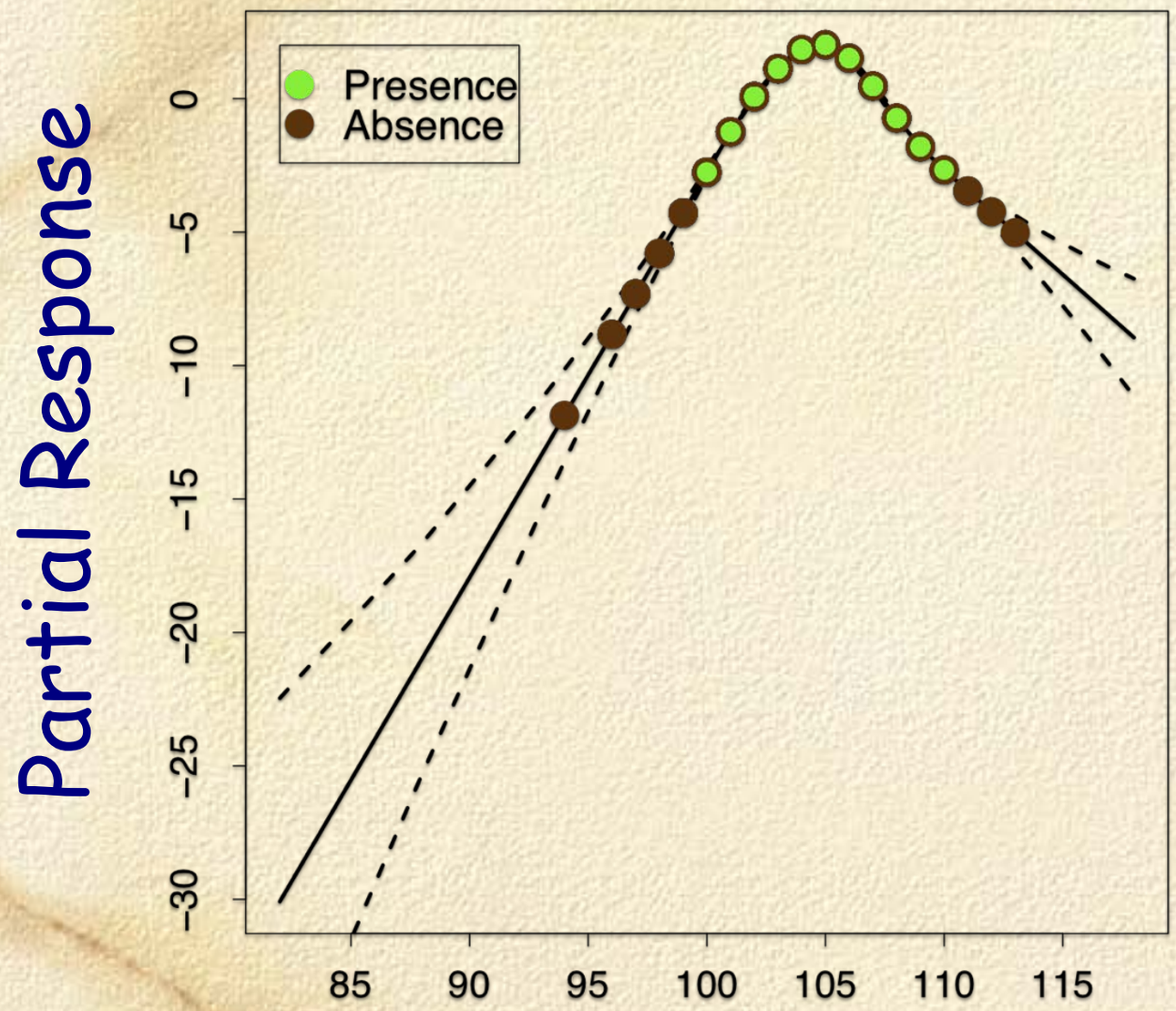
USGS Habitat Model 2009

- Comparable to earlier Models
- Allowed for interpretation of animal response to inputs

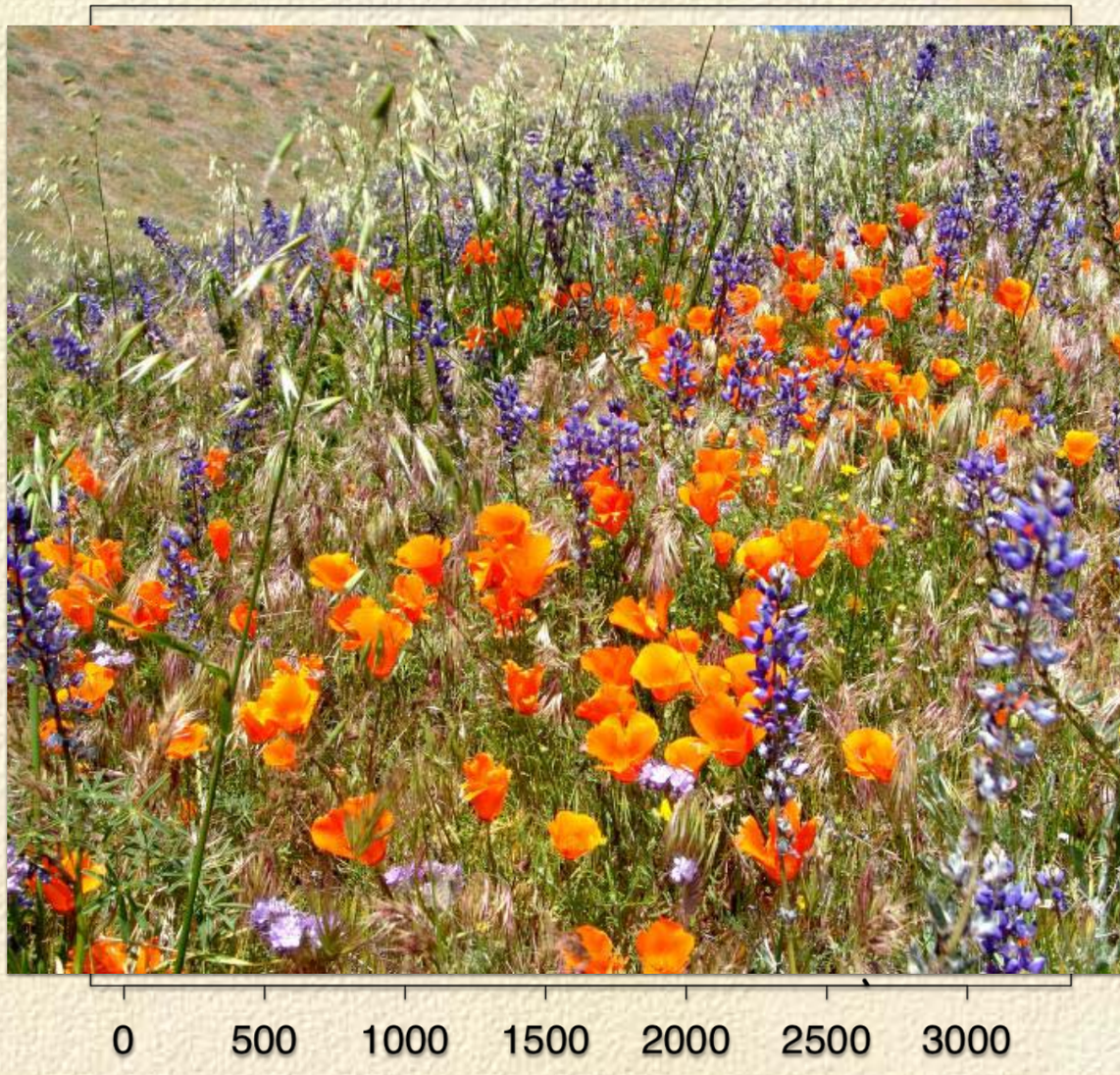


Adapted from Germano et al. 1994 and Nussear et al. 2009

Model Response

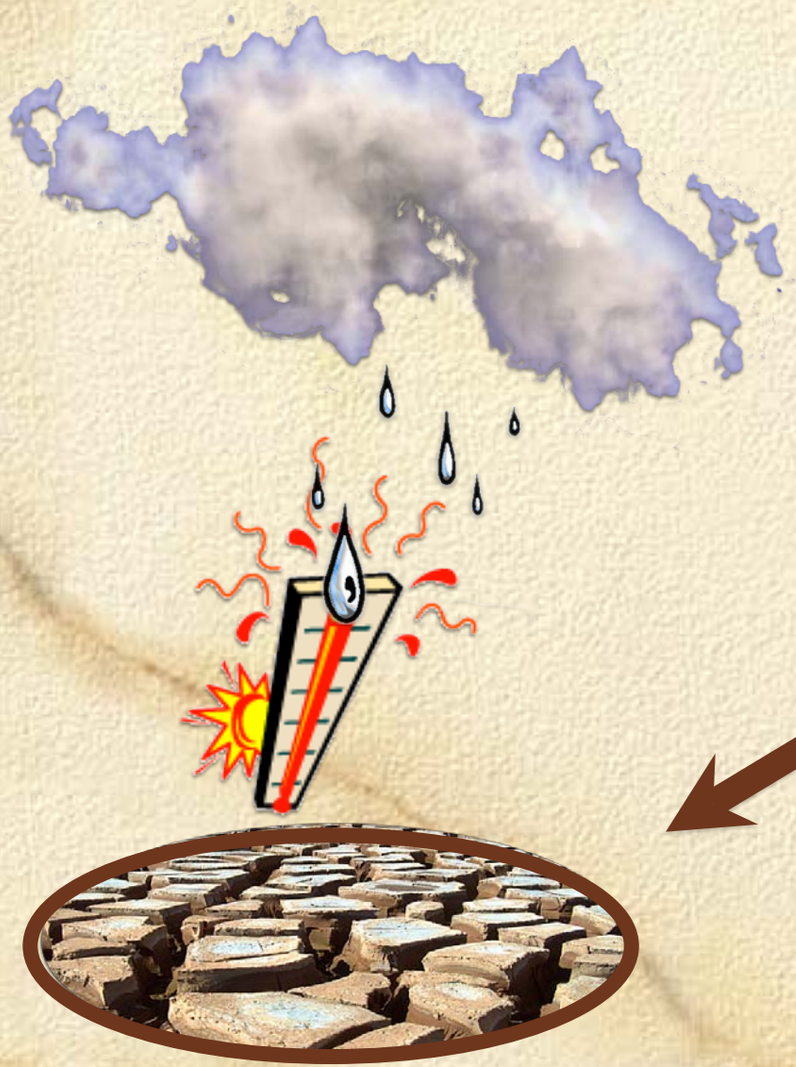


Growth Potential for Annuals

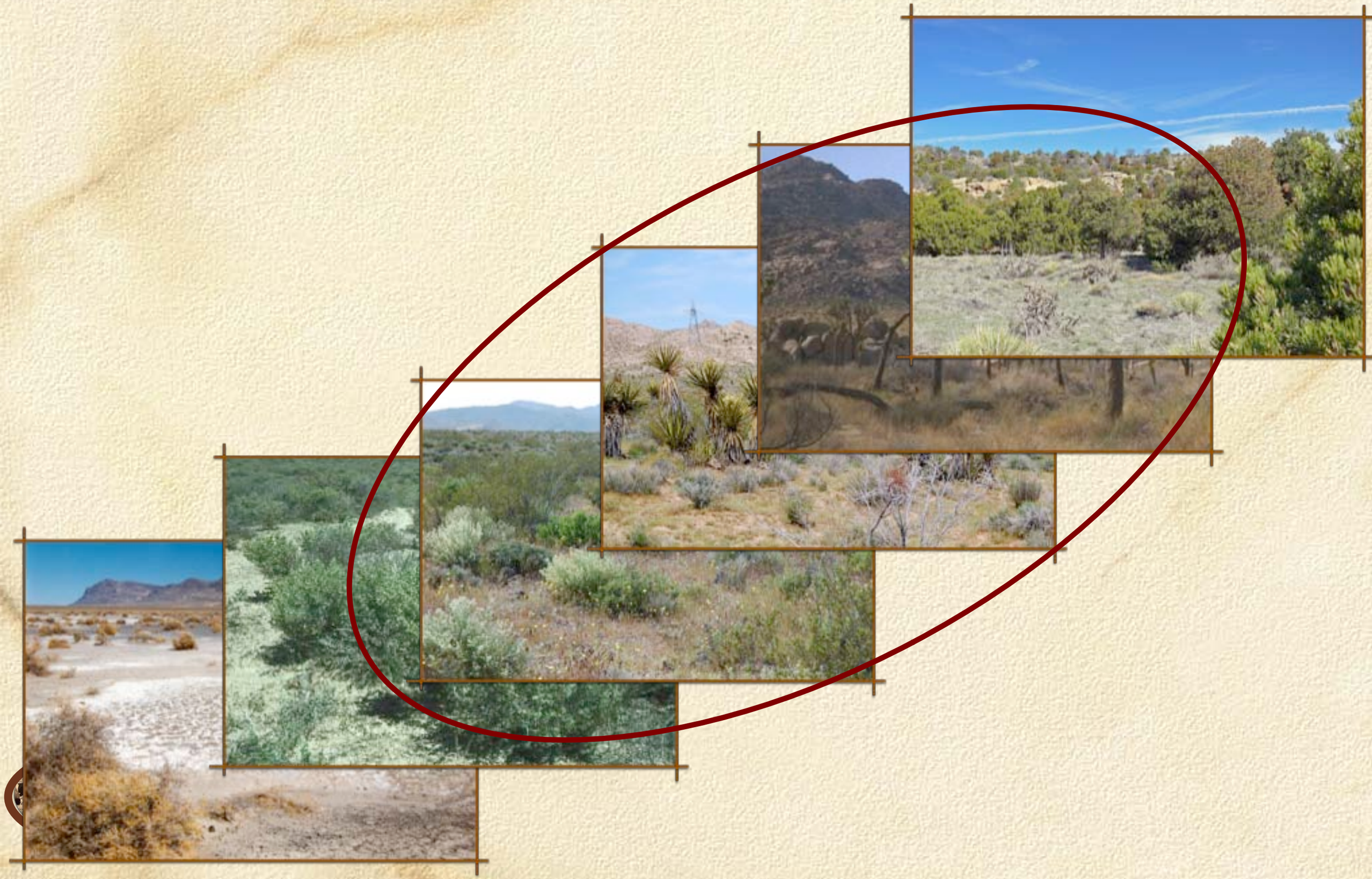


Elevation

Elevational Gradients



Elevational Gradients

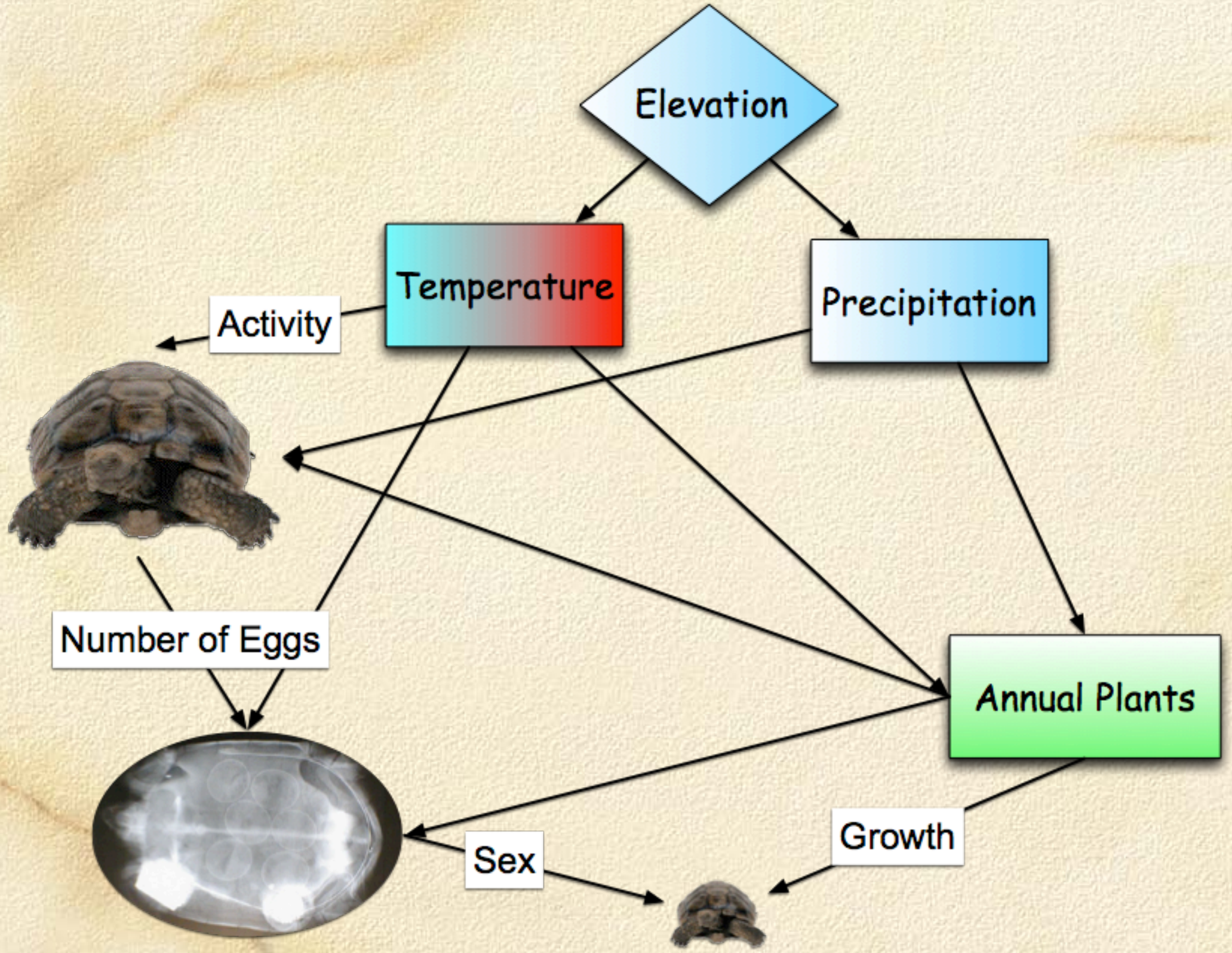


Sources of Future Climate Data

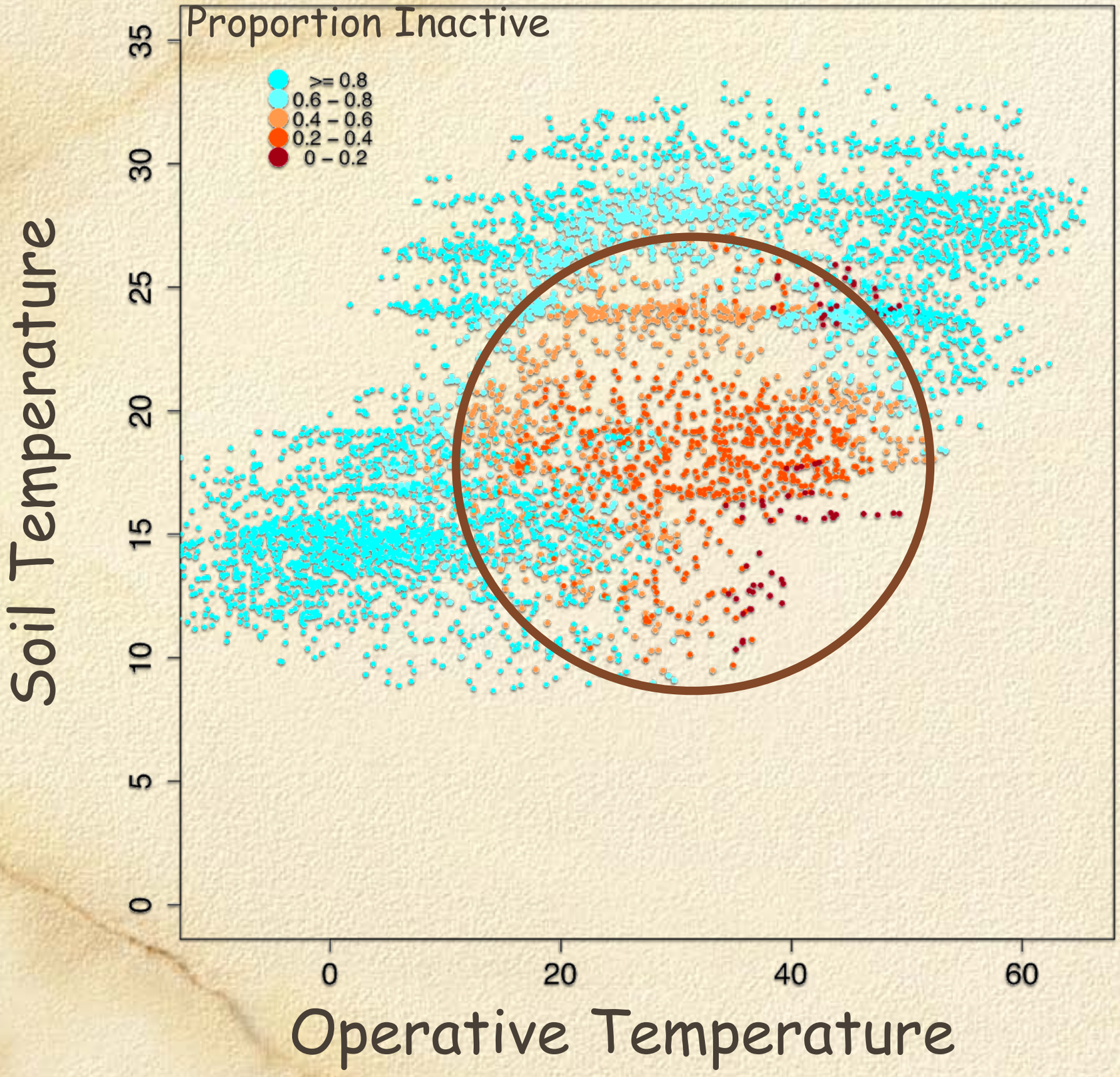
Constraints to Modeling

- Some Variables are NOT available in Future Climate Projections
- Annual Greenup Potential
- Perennial Cover

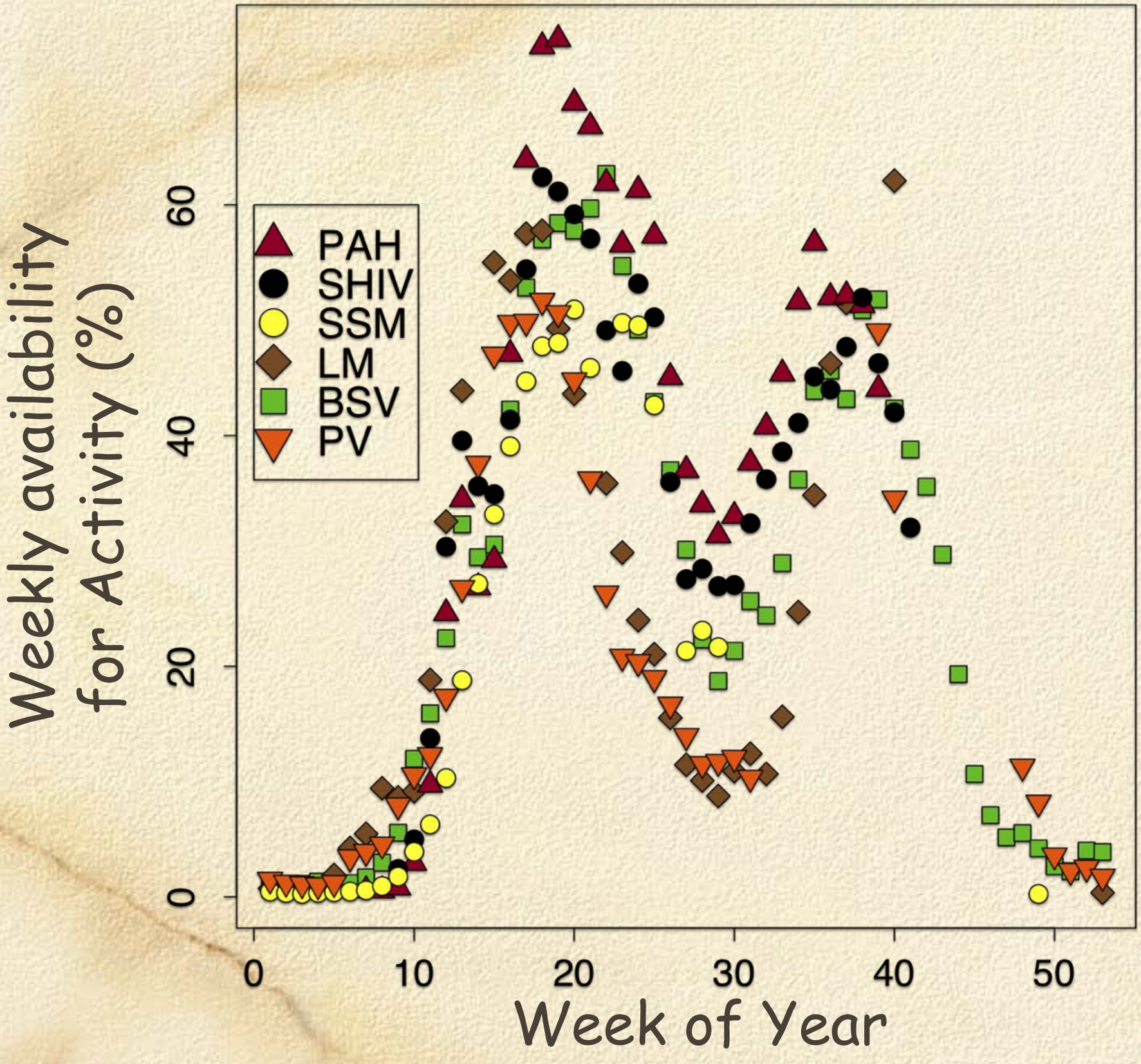
Elevation?


Elevation
Temperature
Precipitation
Activity
Number of Eggs
Annual Plants
Sex
Growth

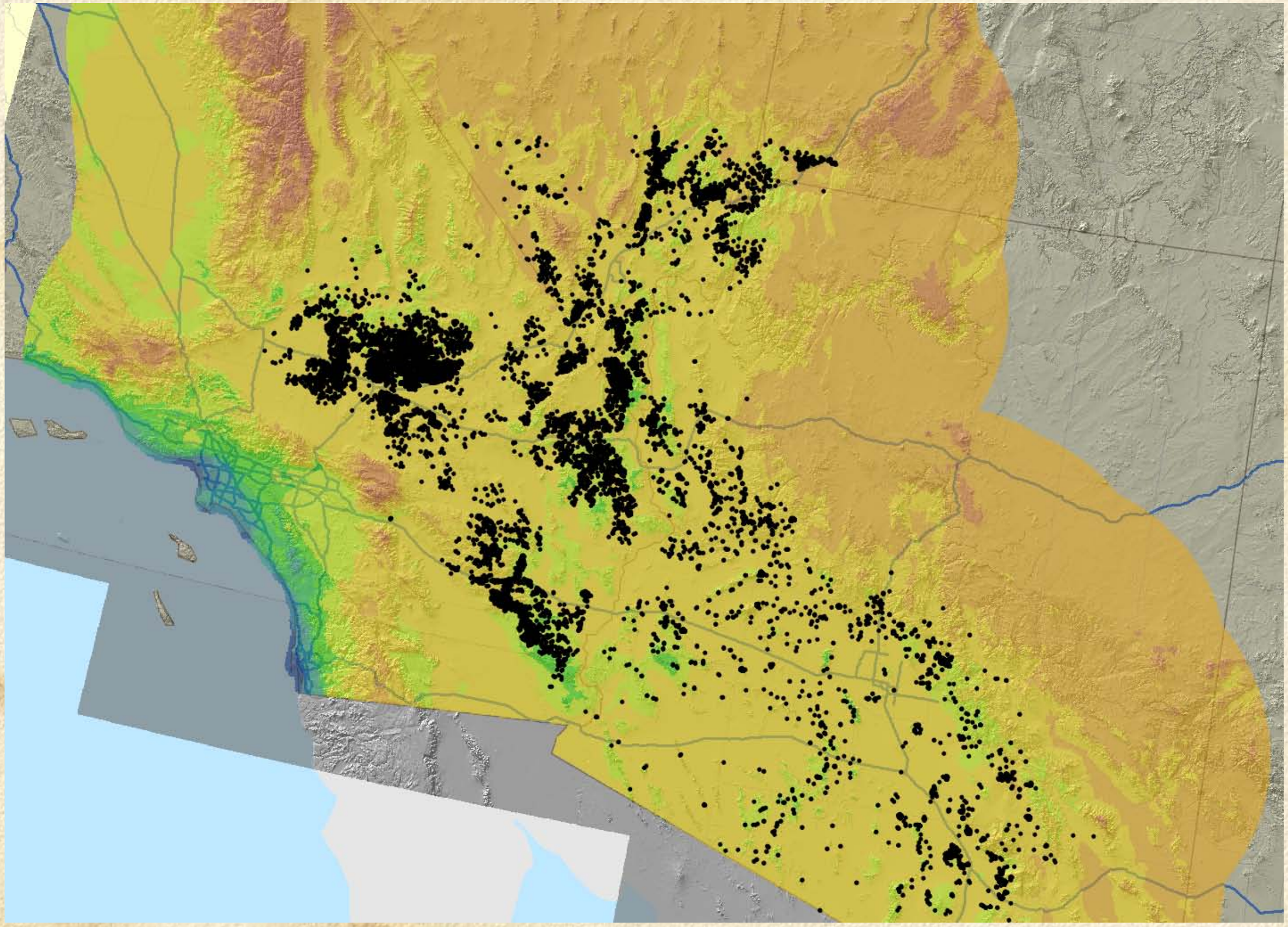
Thermal Environment and Activity



Activity


Weekly availability for Activity (%)
0
20
40
60
PAH
SHIV
SSM
LM
BSV
PV
0
10
20
30
40
50
Week of Year

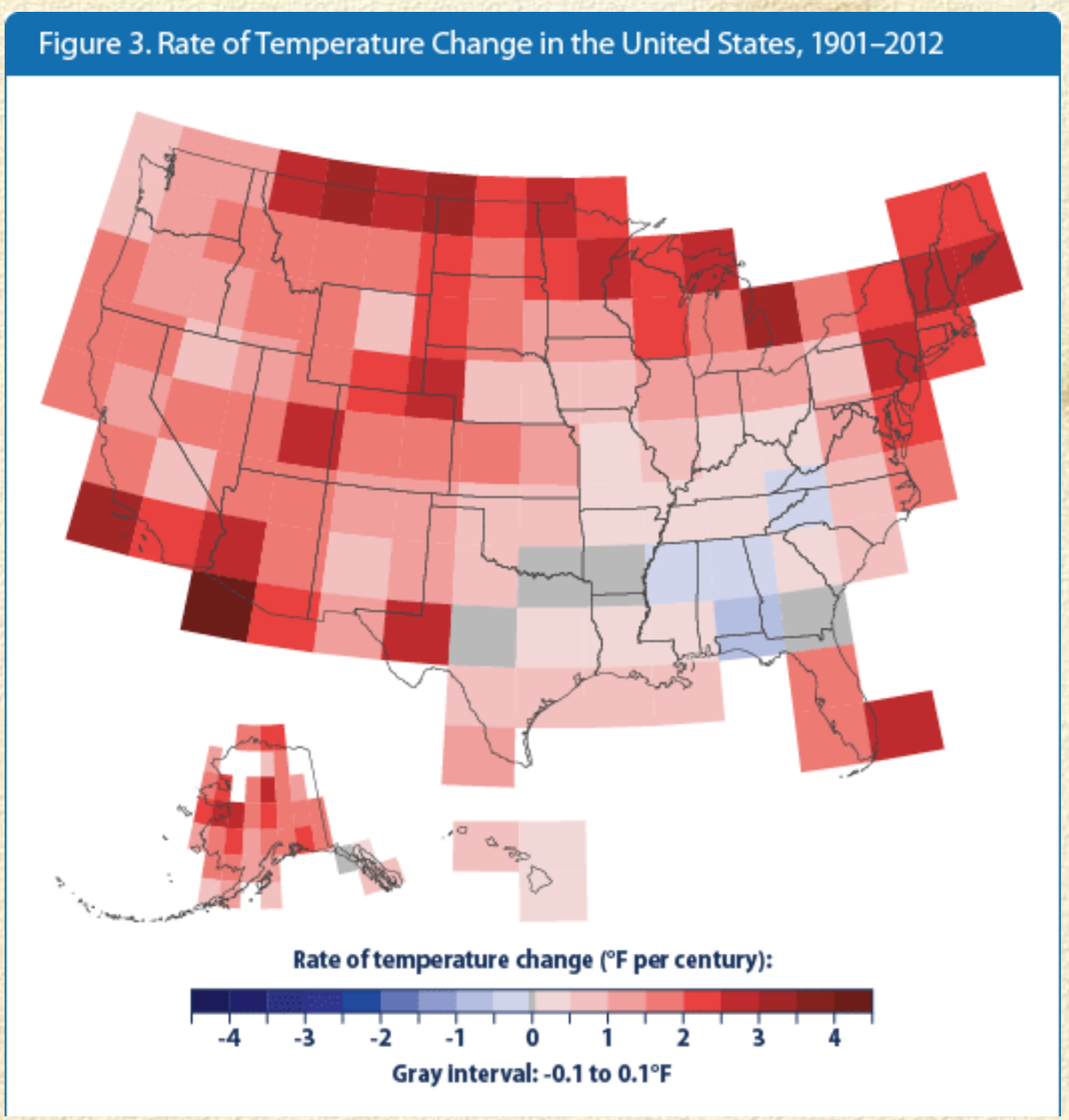
Proportion of Year Available



Sources of Future Climate Data

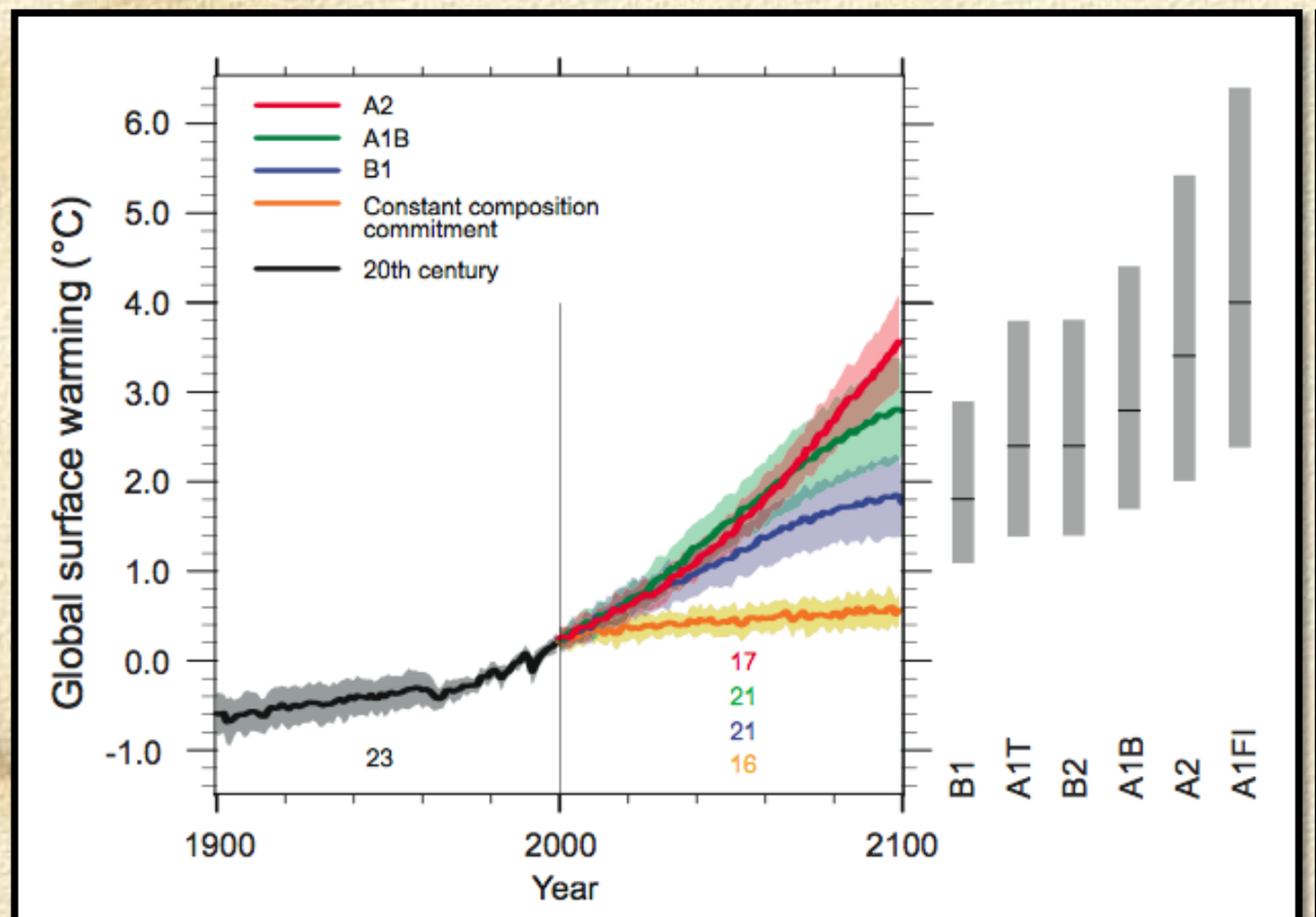
Constraints to Modeling

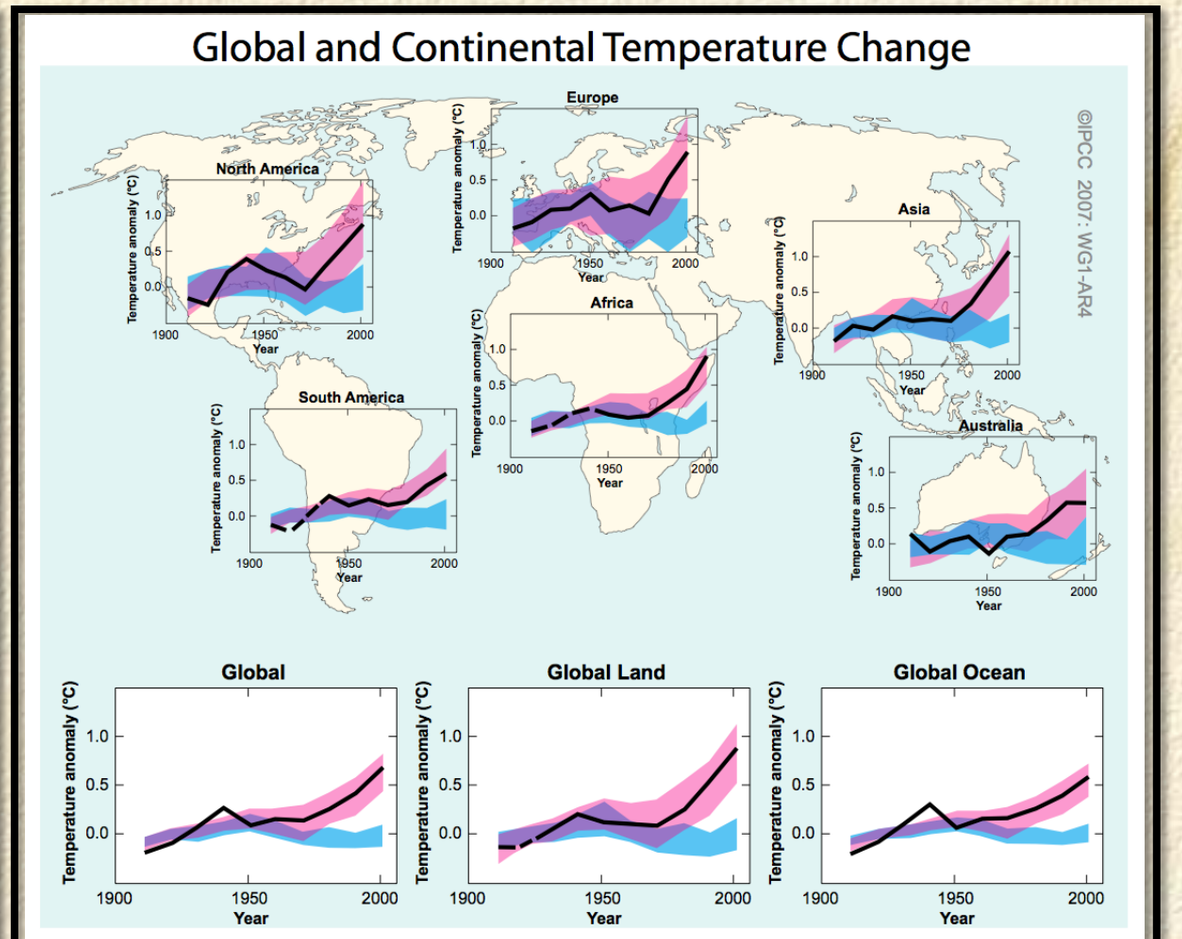
- Spatial Resolution of Climate Variables



Sources of Future Climate Data

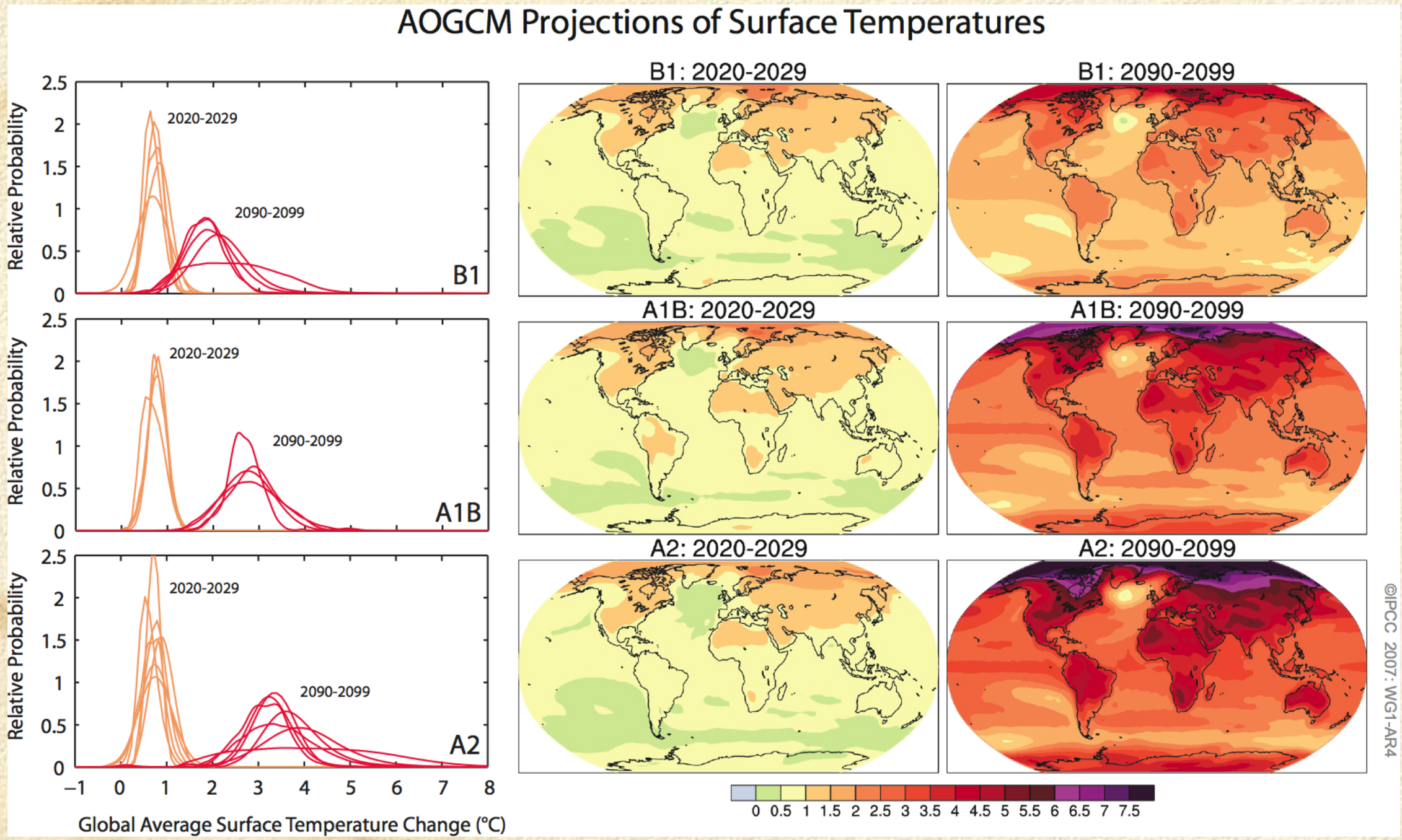
IPCC – global/continental scale focus





Sources of Future Climate Data

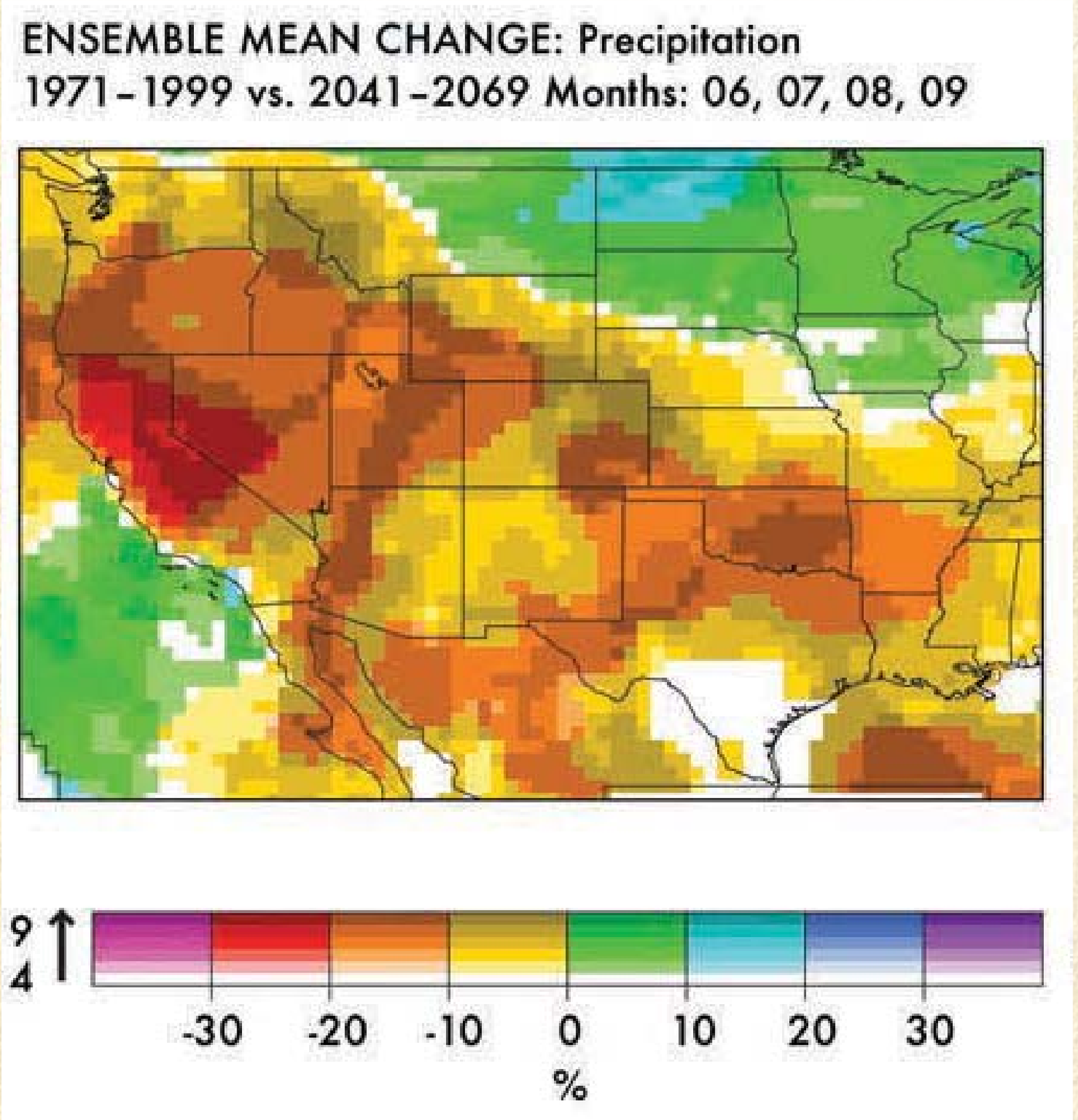
IPCC – Multiple Emmissons Scenarios



Sources of Future Climate Data

IPCC – 15 km resolution – required manual downscaling

WorldClim and others have similar resolution



Data

National Aeronautics and Space Administration
Goddard Space Flight Center

Search NASA.gov

NCCS | Sciences and Exploration

CISTO Climate Data Services

NASA Links

- NASA
- GSFC
- HEC
- CISTO
- NCCS
- GMAO
- GISS
- GES DISC
- HSL
- SVS

NEX - NASA Earth Exchange Downscaled Project

Description

The NASA Earth Exchange (NEX) Downscaled Climate Projections (NEX-DCP30) dataset is comprised of downscaled climate scenarios for the conterminous United States that are derived from the General Circulation Model (GCM) runs conducted under the Coupled Model Intercomparison Project Phase 5 (CMIP5) [Taylor et al. 2012] and across the four greenhouse gas emissions scenarios known as Representative Concentration Pathways (RCPs) [Meinshausen et al. 2011] developed for the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC AR5). The dataset includes downscaled projections from 33 models, as well as ensemble statistics calculated for each RCP from all model runs available. The purpose of these datasets is to provide a set of high resolution, bias-corrected climate change projections that can be used to evaluate climate change impacts on processes that are sensitive to finer-scale climate gradients and the effects of local topography on climate conditions.

Each of the climate projections includes monthly averaged maximum temperature, minimum temperature, and precipitation for the periods from 1950 through 2005 (Retrospective Run) and from 2006 to 2099 (Prospective Run).

Data Access

Data Service Name: Earth System Grid Federation, ESGF
Data Service Information: Search, Download, Visualize (LAS)
Data Service Access URL: ESGF
Click on Search, select Project "NEX".

Data Service Name: NCCS THREDDS
Data Service Information: Search, Subset, Download, Visualize
Data Service Access URL: NCCS THREDDS
Select Project "NEX".

Contact

Data Services Information

- Data Portal Hardware Site
- Data Services Documentation
- Original NCCS Dataportal website

NCCS Information

- NCCS User ID Requests
- NCCS FAQ
- Footprints Login
- User Forum
- Weekly User Telecon
- News
- Get More Help

Contact Us

- Contact NCCS User Services at support@nccs.nasa.gov or 301-286-9120
- **Hours of Operation:** Monday through Friday 8 a.m. to 6 p.m. Eastern Time (U.S.)
- Follow us on Twitter!

Environmental Layers in Models

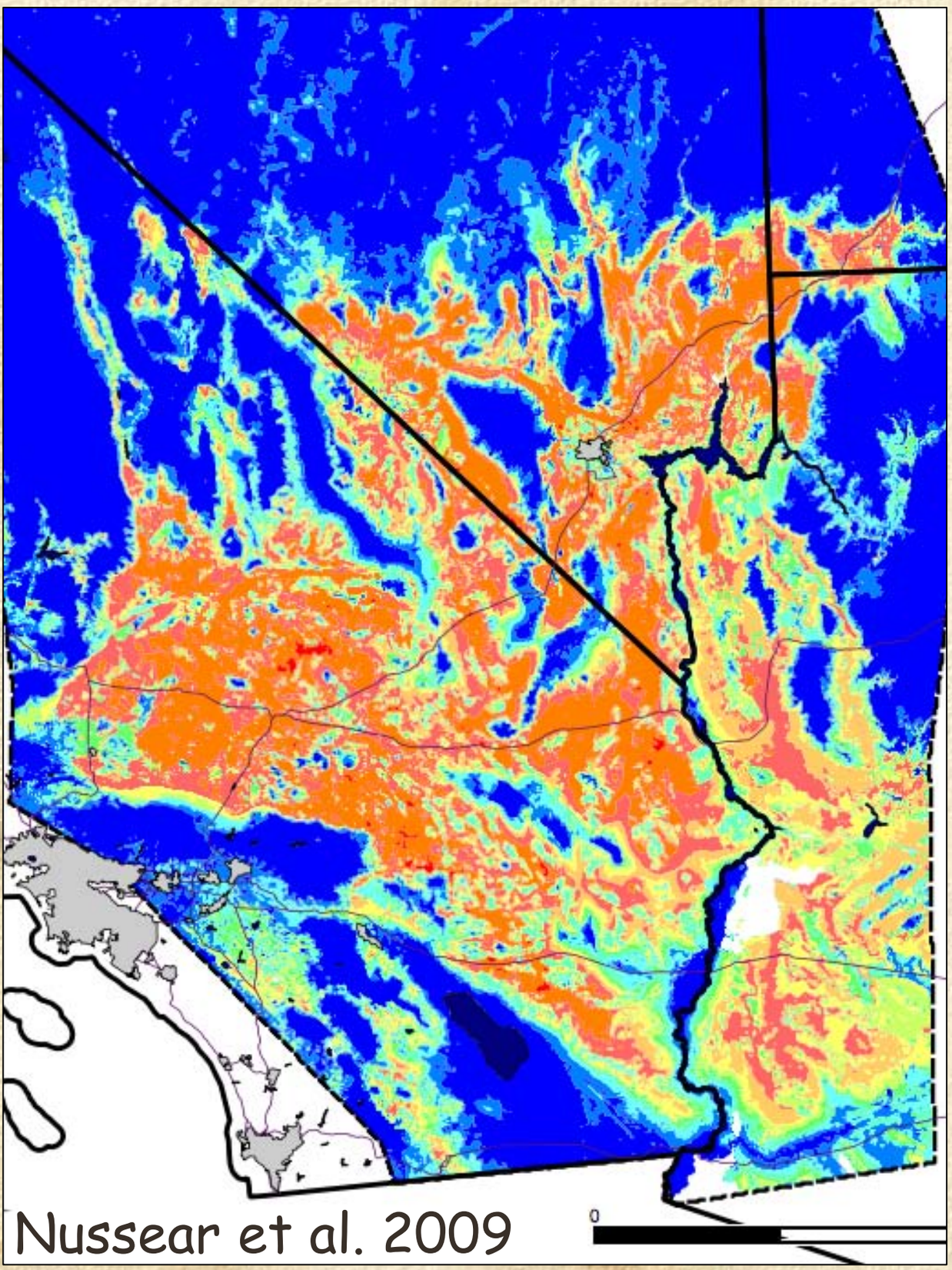
2009

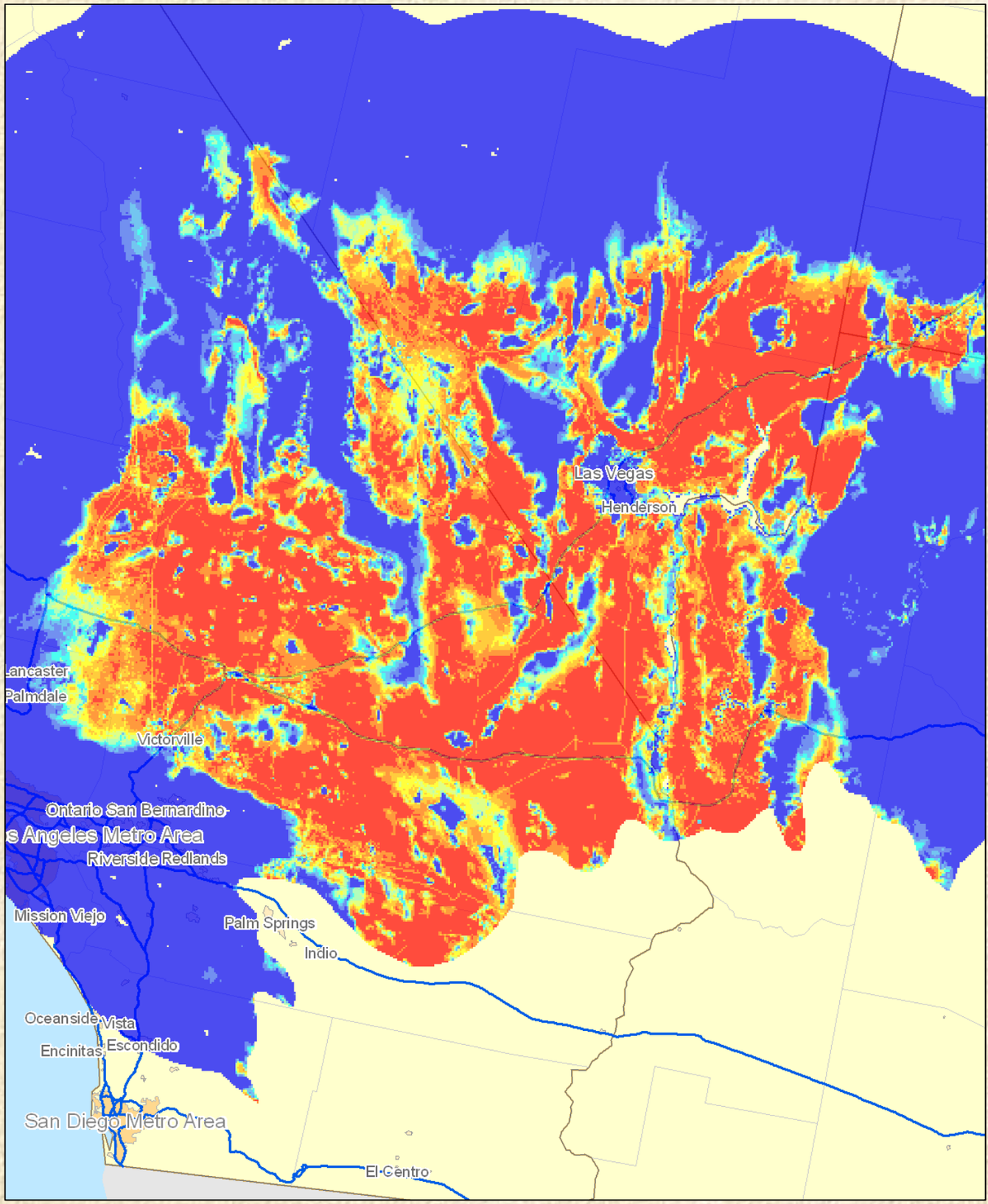
- **CLIMATE**
  - Mean dry season precipitation
  - Mean wet season precipitation
- **TOPOGRAPHY**
  - Elevation
  - Average surface roughness
  - Percent smooth
- **SOILS**
  - Average soil bulk density
  - Depth to bedrock
  - Average percentage of rocks > 254 mm B-axis diameter
- **BIOLOGICAL CHARACTERISTICS**
  - Perennial plant cover
  - Annual Greenup Potential

2014

- **CLIMATE**
  - Probability of Drought
  - Ratio of Summer to Winter Precipitation
  - Seasonal Temperature Difference
  - Summer Maximum Temperature
- **TOPOGRAPHY/SOILS**
  - Surface Texture
  - Surface Roughness
- **BIOLOGICAL CHARACTERISTICS**
  - Proportion of Season Available for Activity
- Two Future Climate Scenarios
  - 2.5 climate forcing (B2)
  - 8.5 climate forcing (A1)

USGS Habitat Models



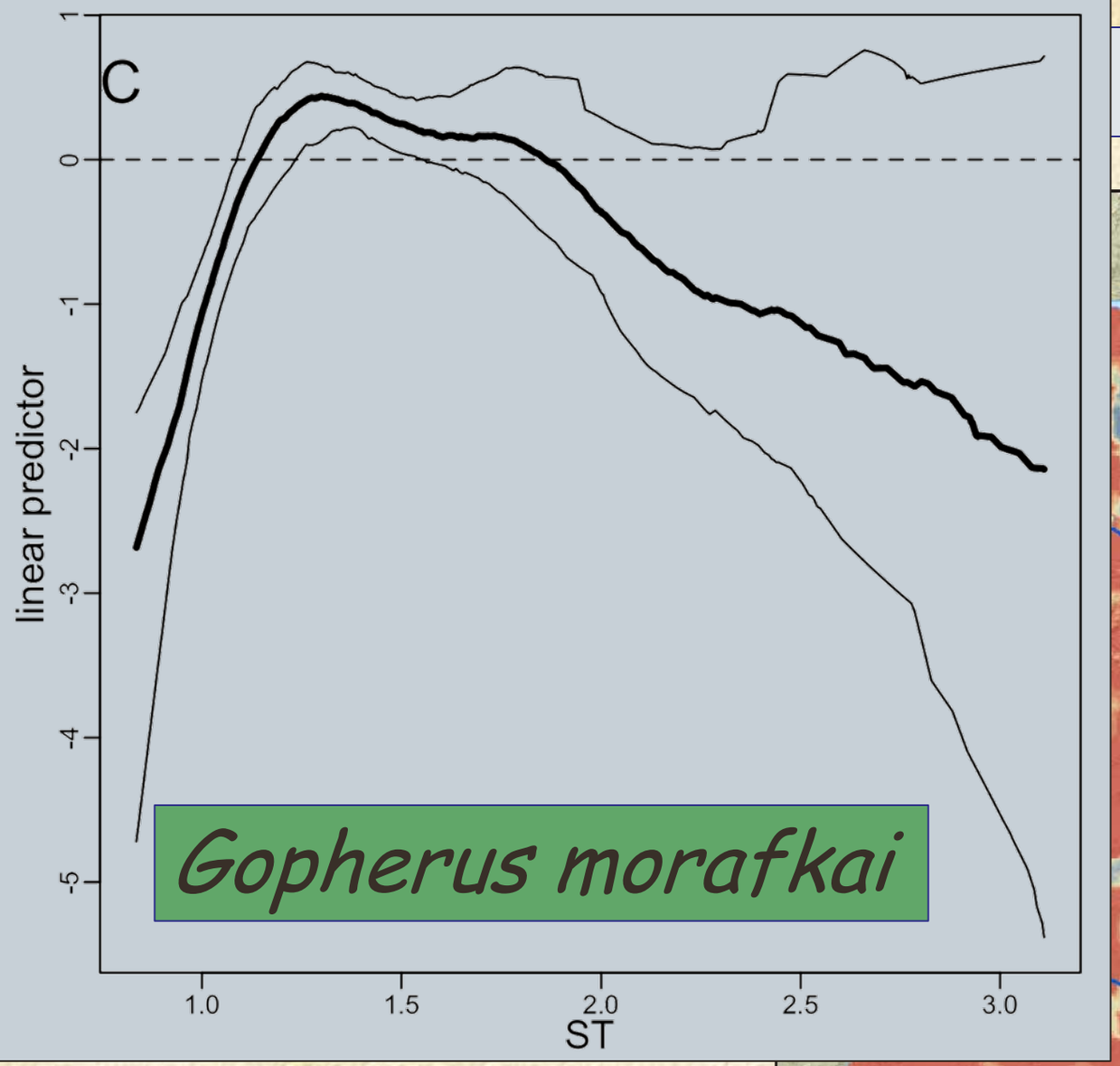


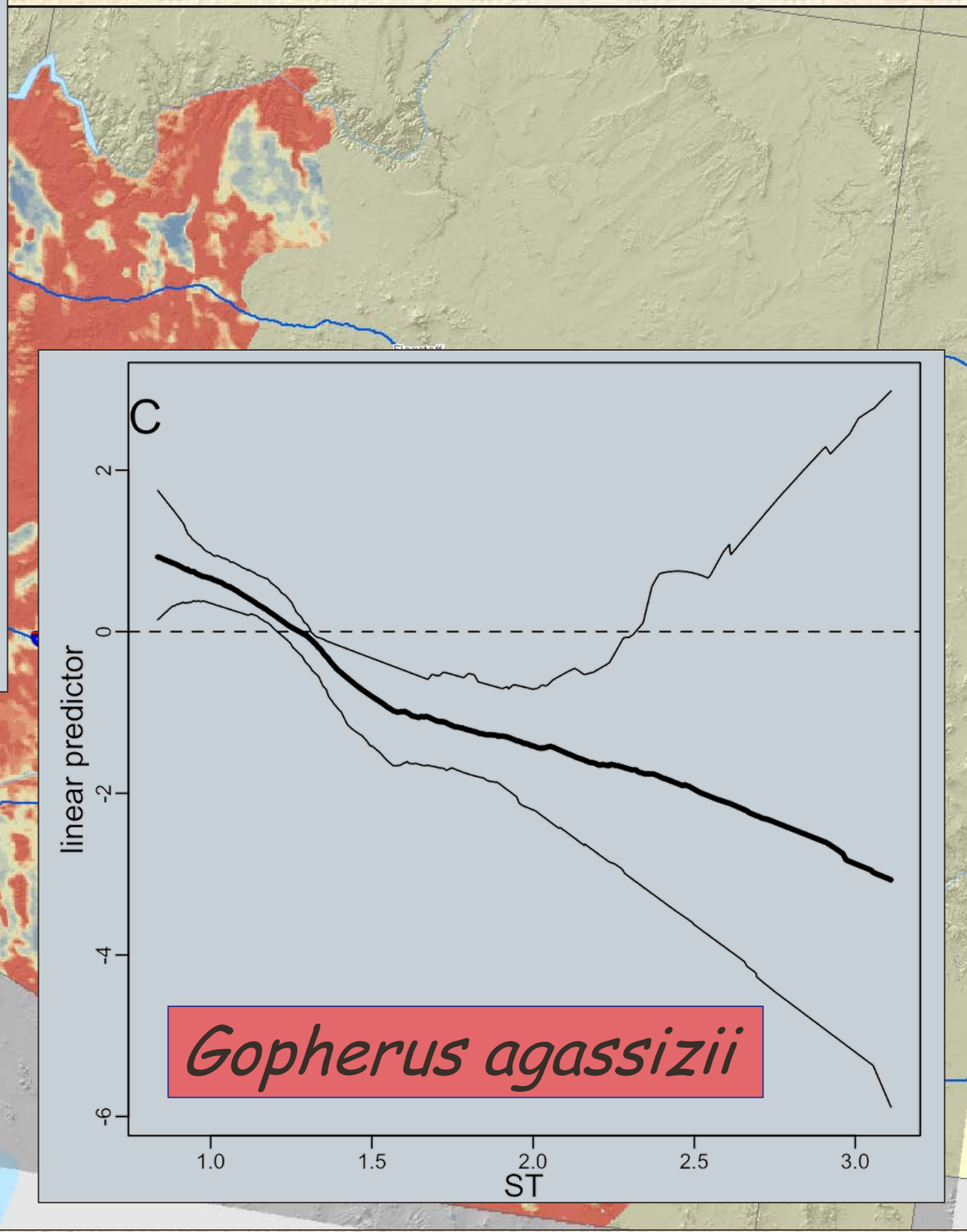
SDT Habitat Model

What's in the model?

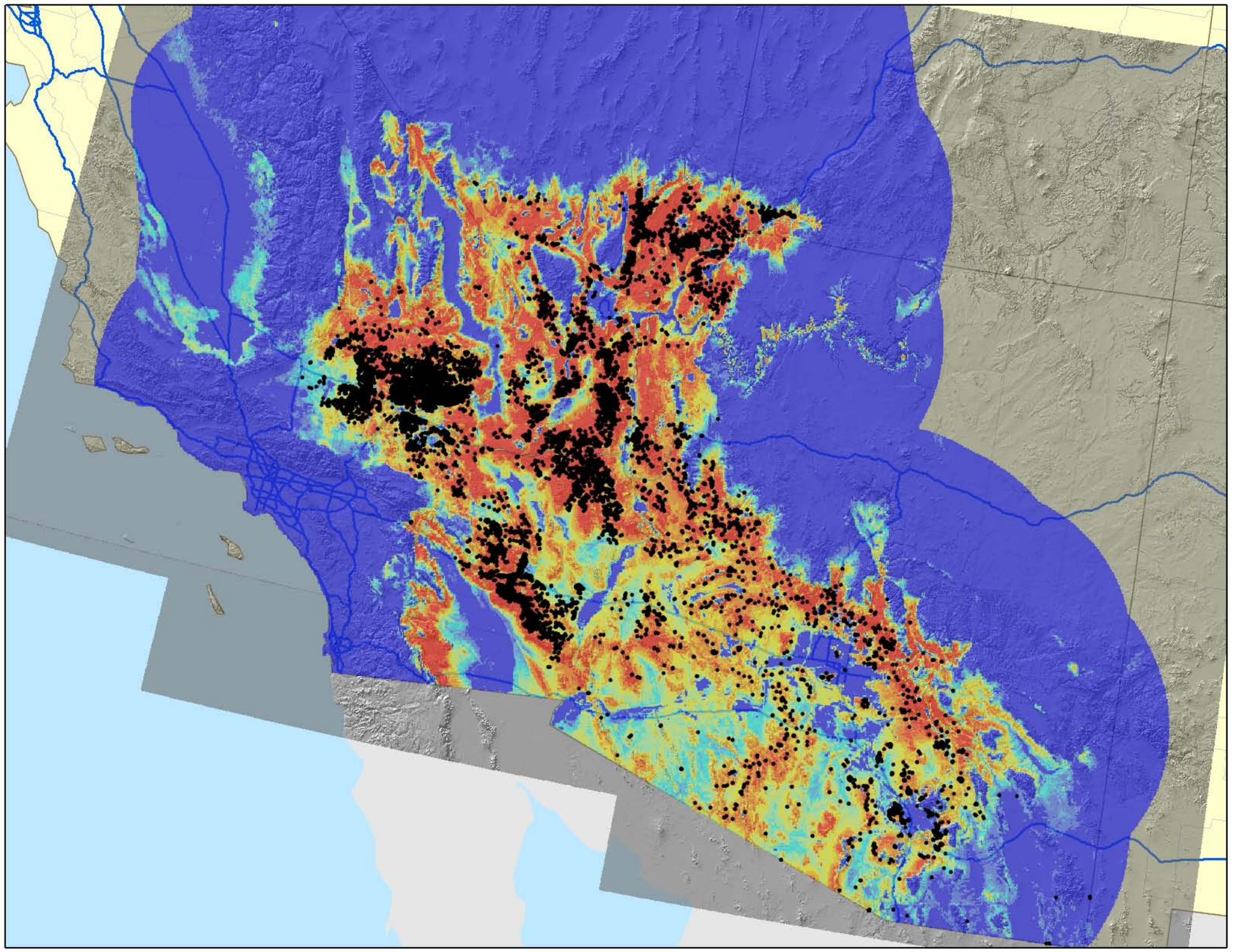
- Surface Roughness
- Topographic Position
- Surface Texture
- Winter Precipitation
- Summer/Winter Precipitation Ratio
- Maximum Summer Temperature
- Summer/Winter Temperature Difference

Covariate Contributions

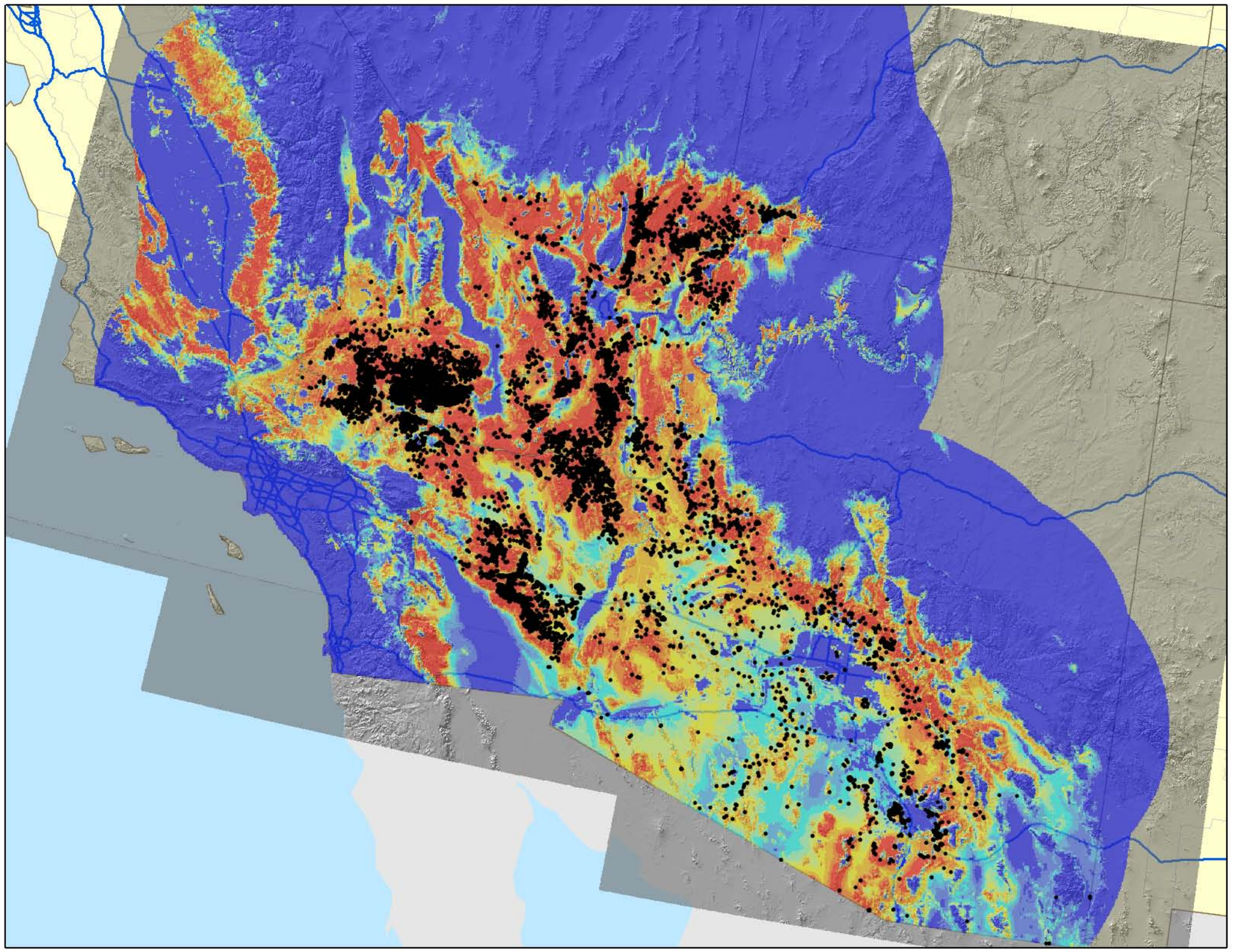




Habitat Model - Present

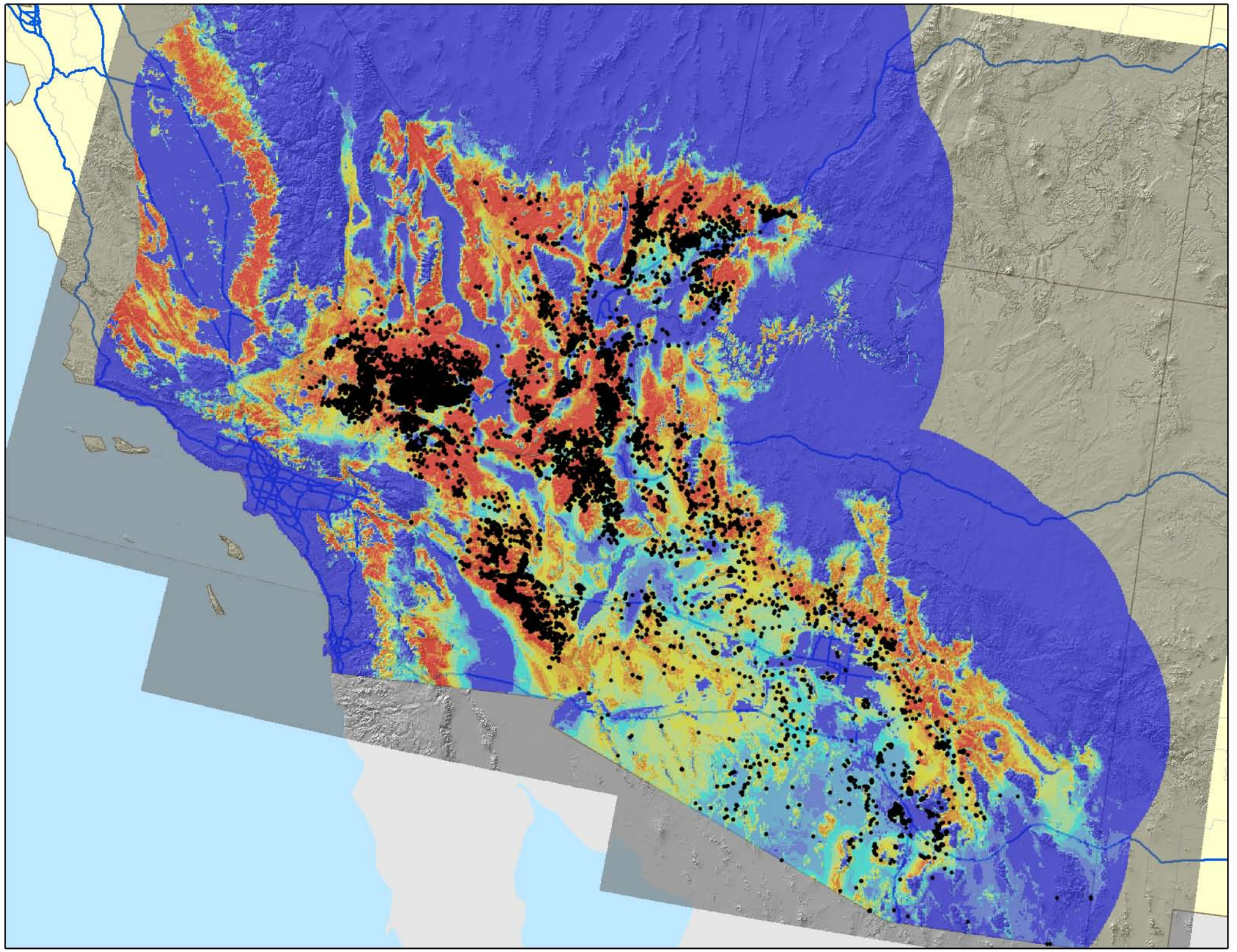


Habitat Model - 2040



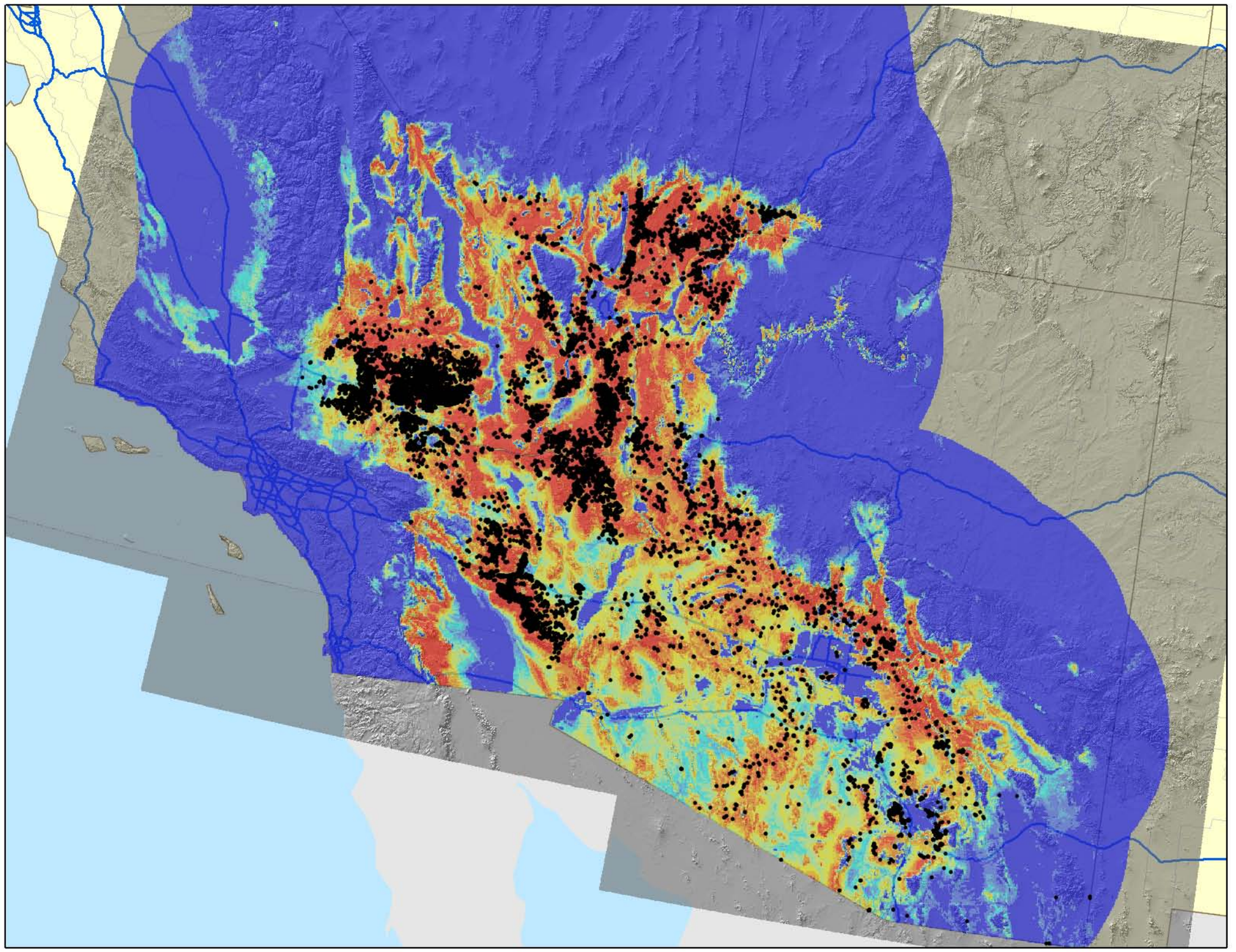
CMIP3 – Forcing level 2.5

Habitat Model - 2095

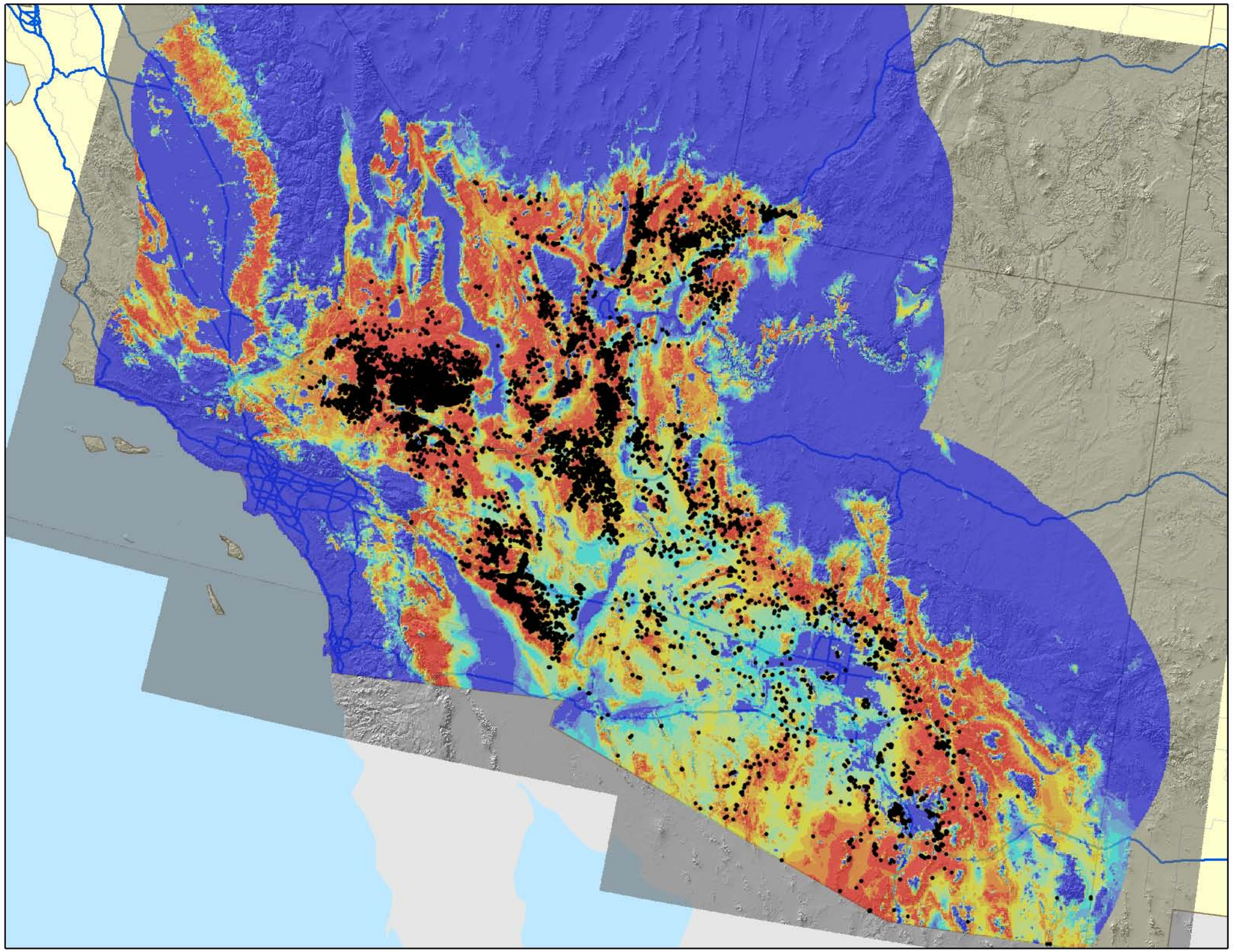


CMIP3 - Forcing level 2.5

Habitat Model - Present

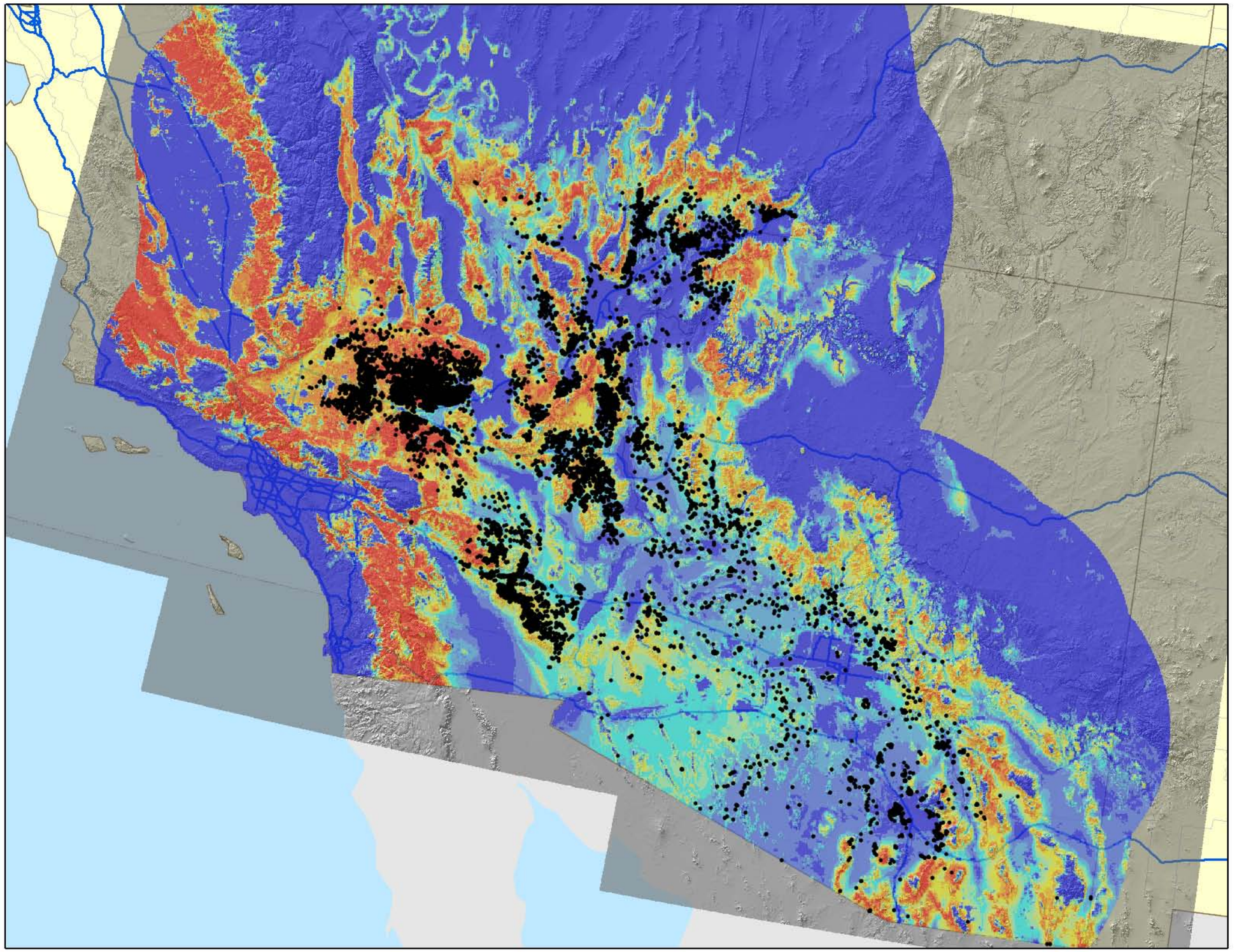


Habitat Model - 2040



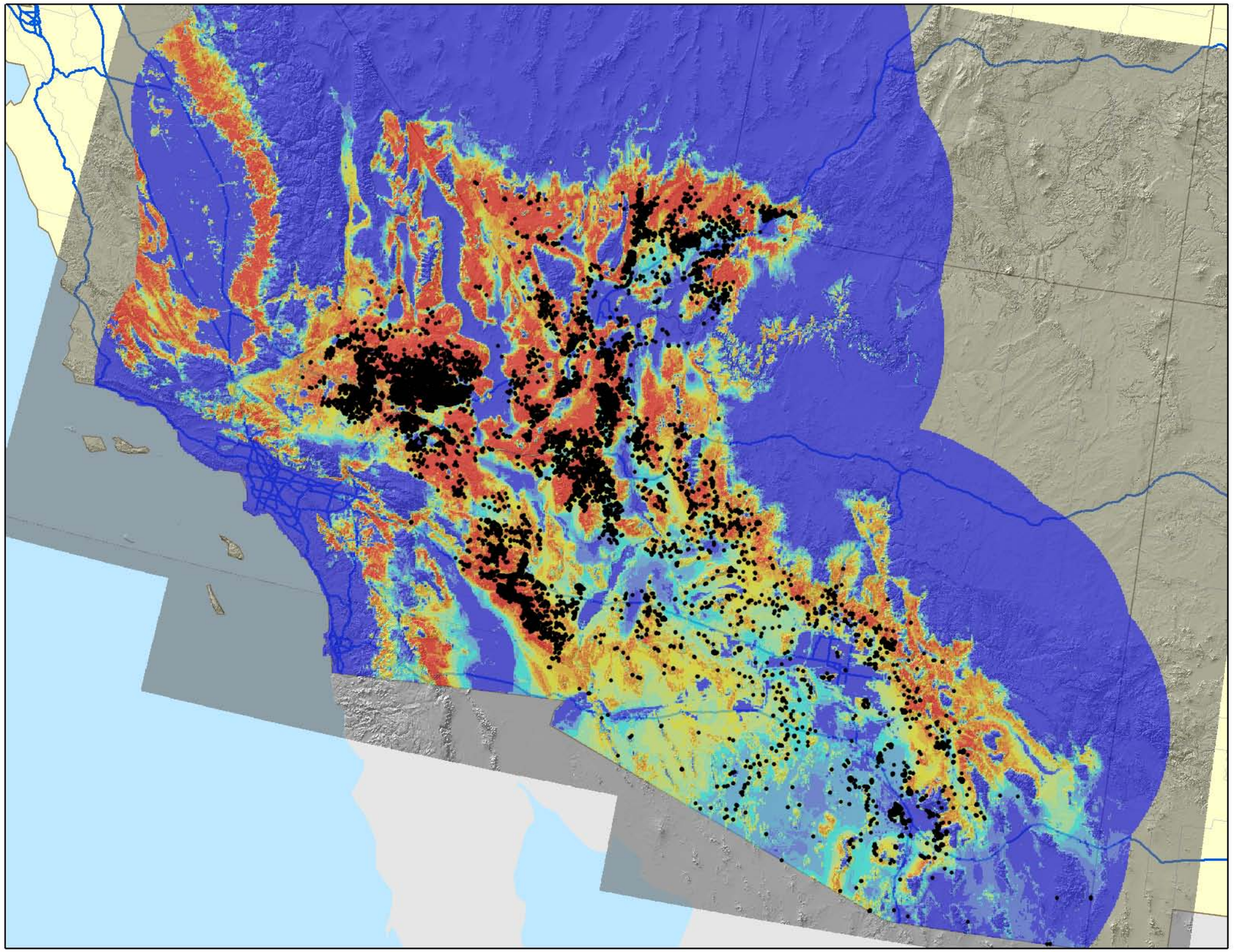
CMIP3 - Forcing level 8.5

Habitat Model – 2095



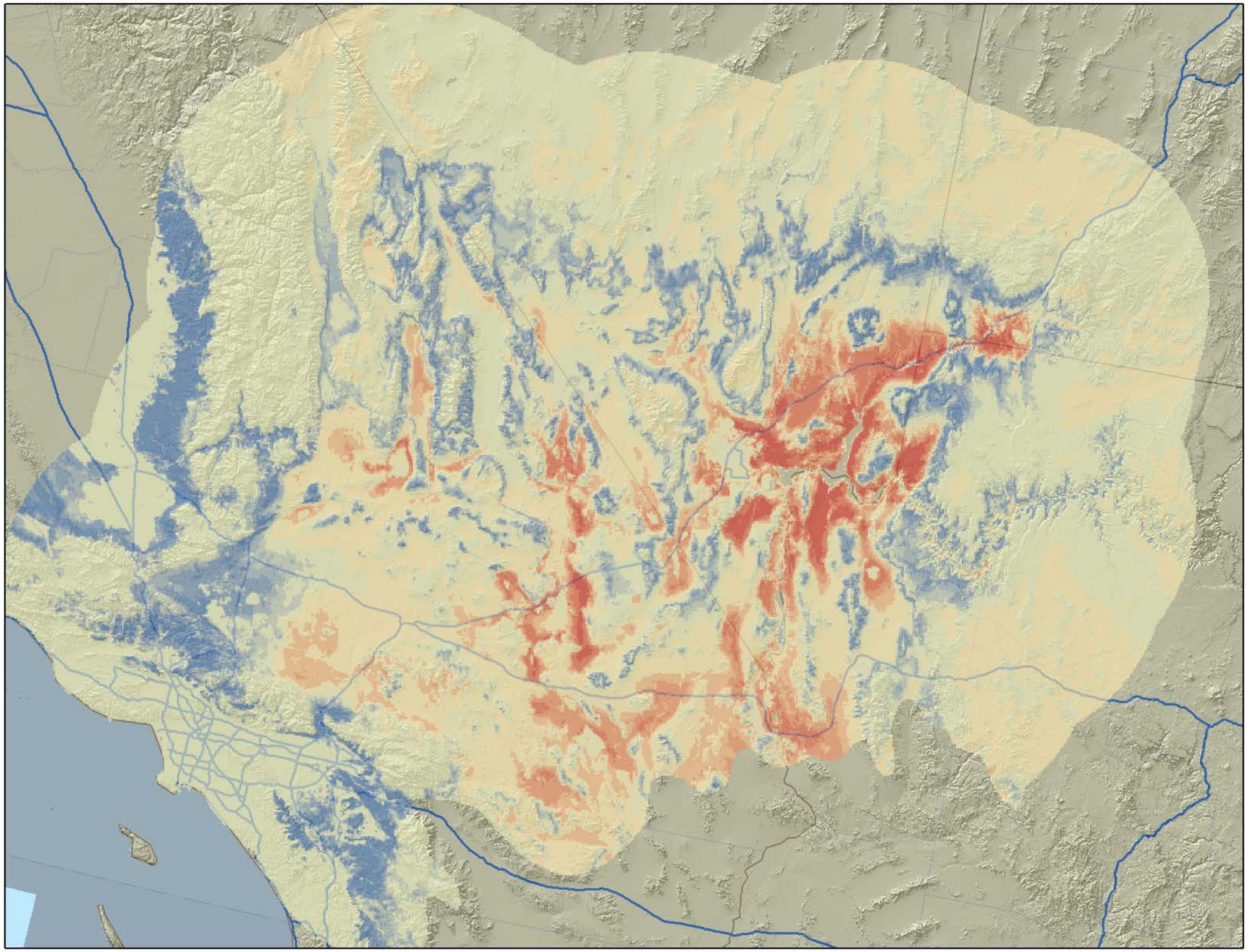
CMIP3 - Forcing level 8.5

Habitat Model - 2095

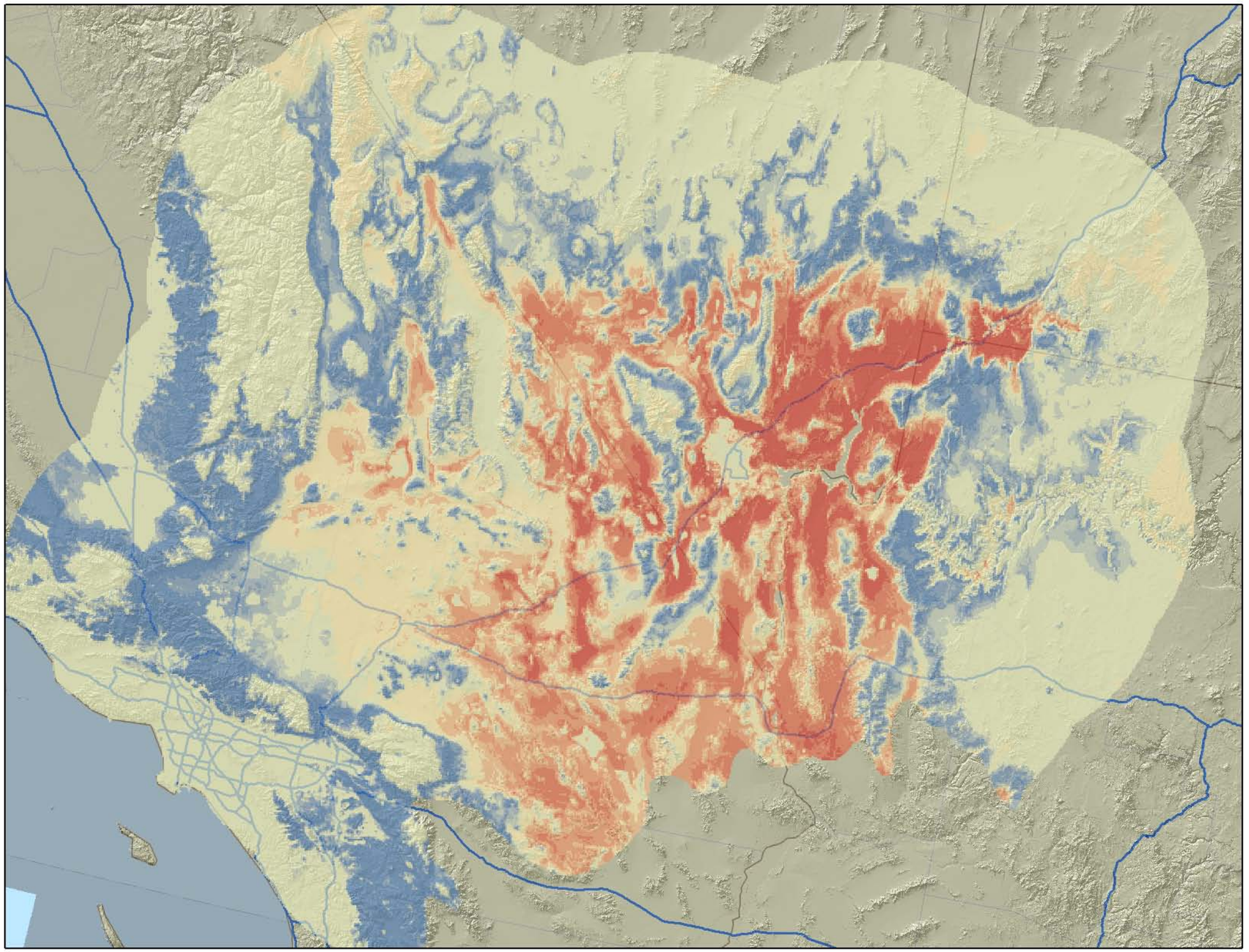


CMIP3 - Forcing level 2.5

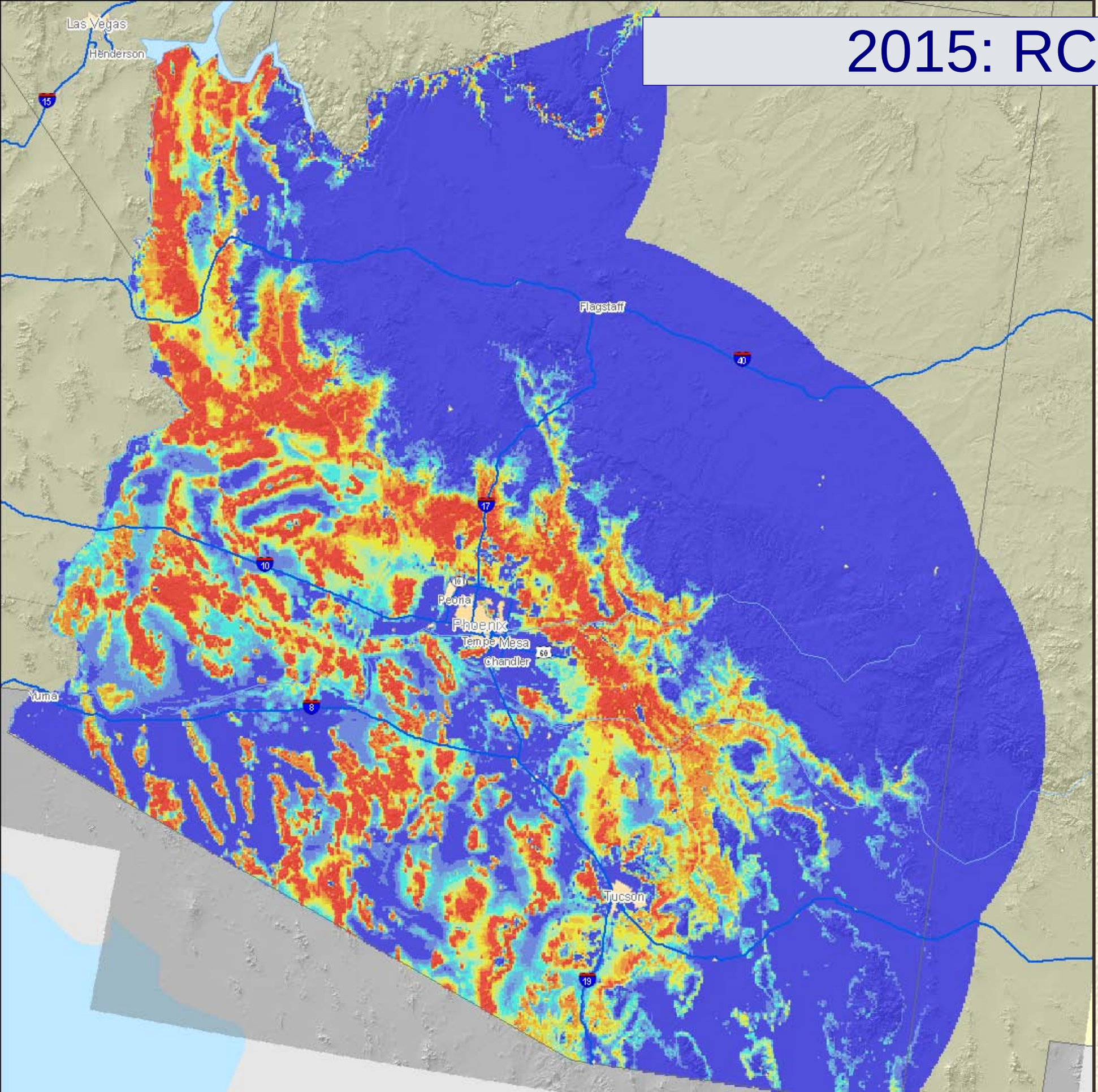
2095



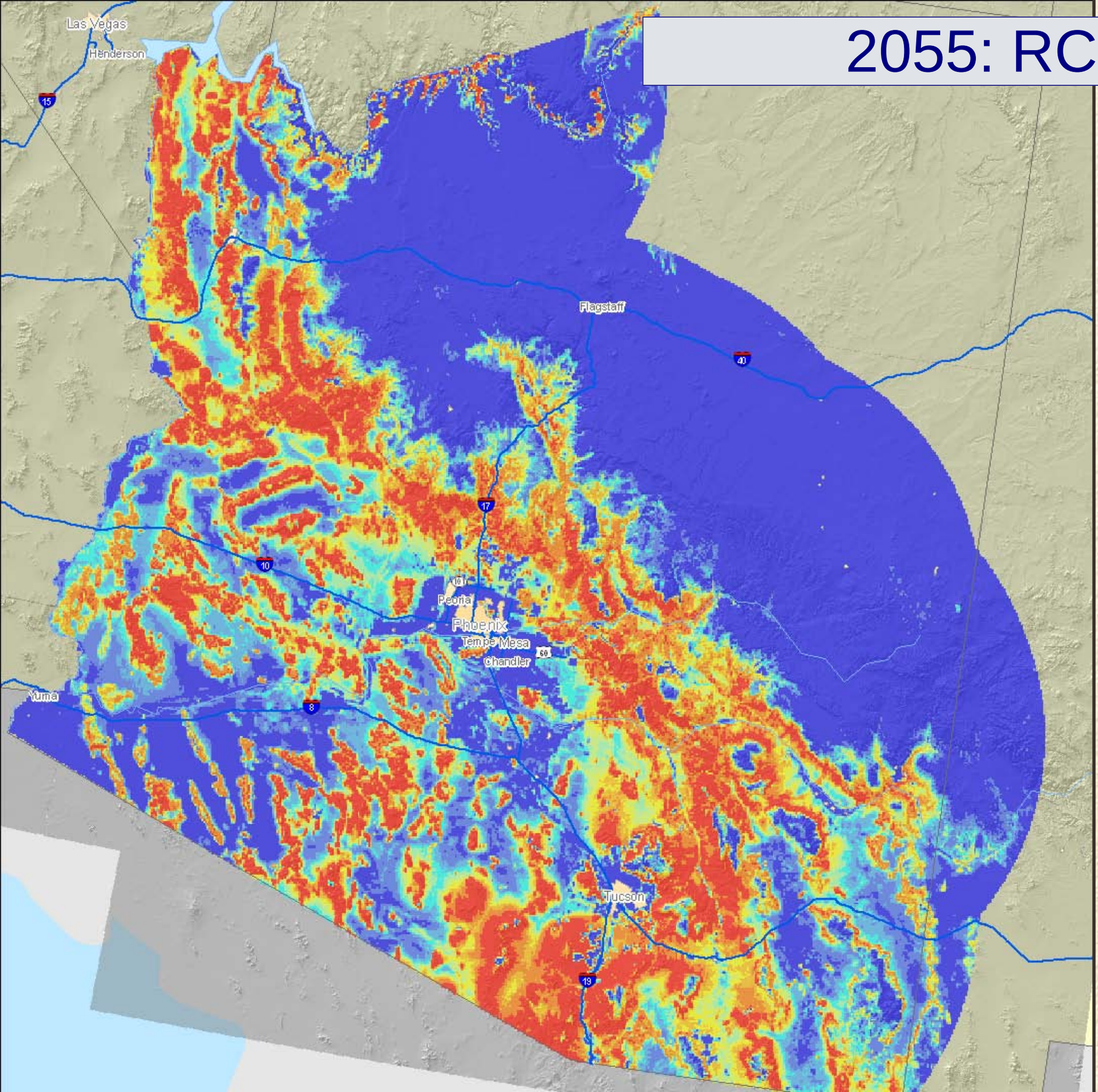
2095



2015: RCP 8.5


Las Vegas
Henderson
15
Flagstaff
40
17
10
101
Peoria
Phoenix
Tempe
Mesa
Chandler
60
Yuma
8
Tucson
19

2055: RCP 8.5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Peoria
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Tempe
Mesa
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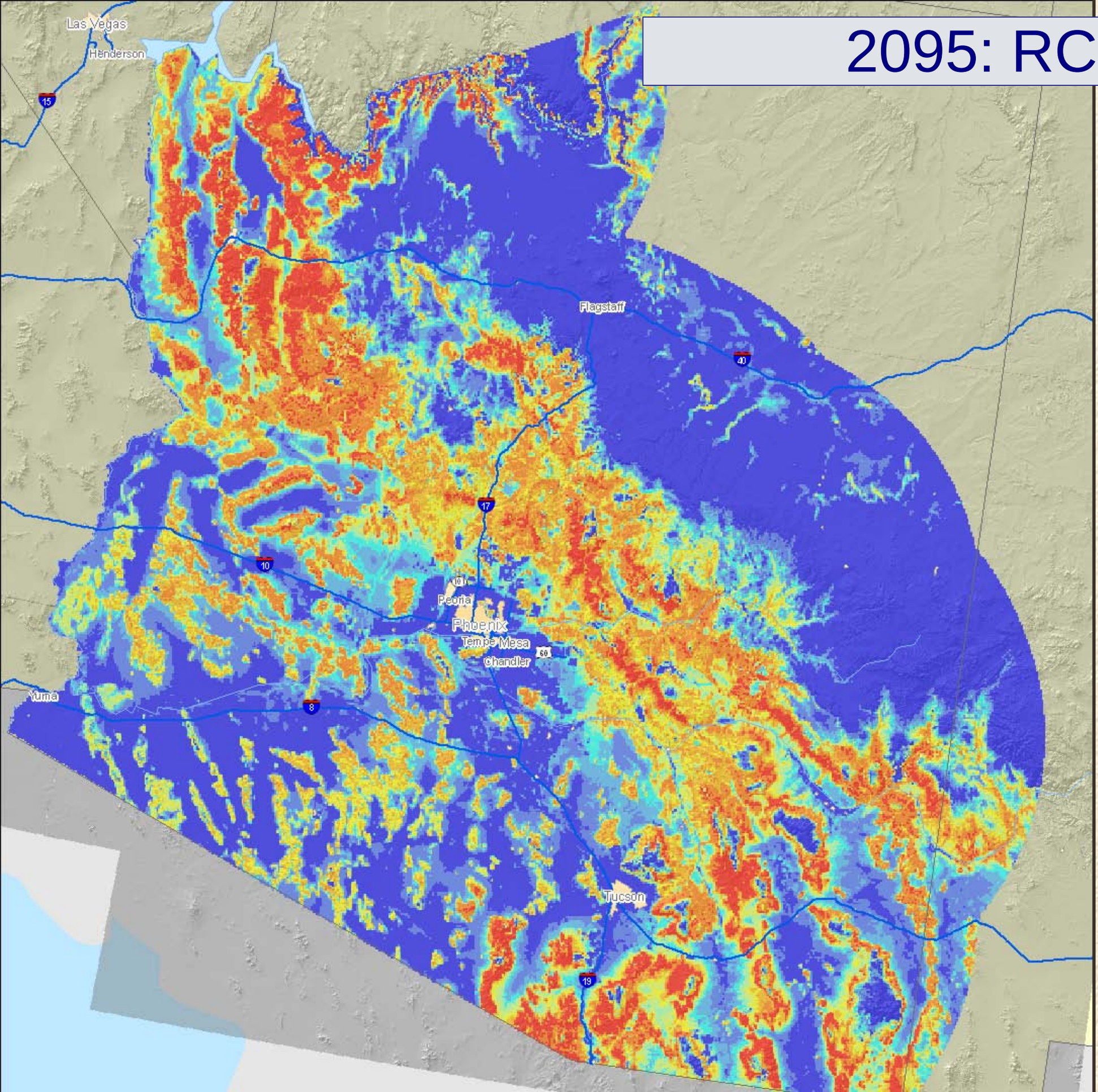
Chandler
Yuma
8
Tucson
19

2095: RCP 8.5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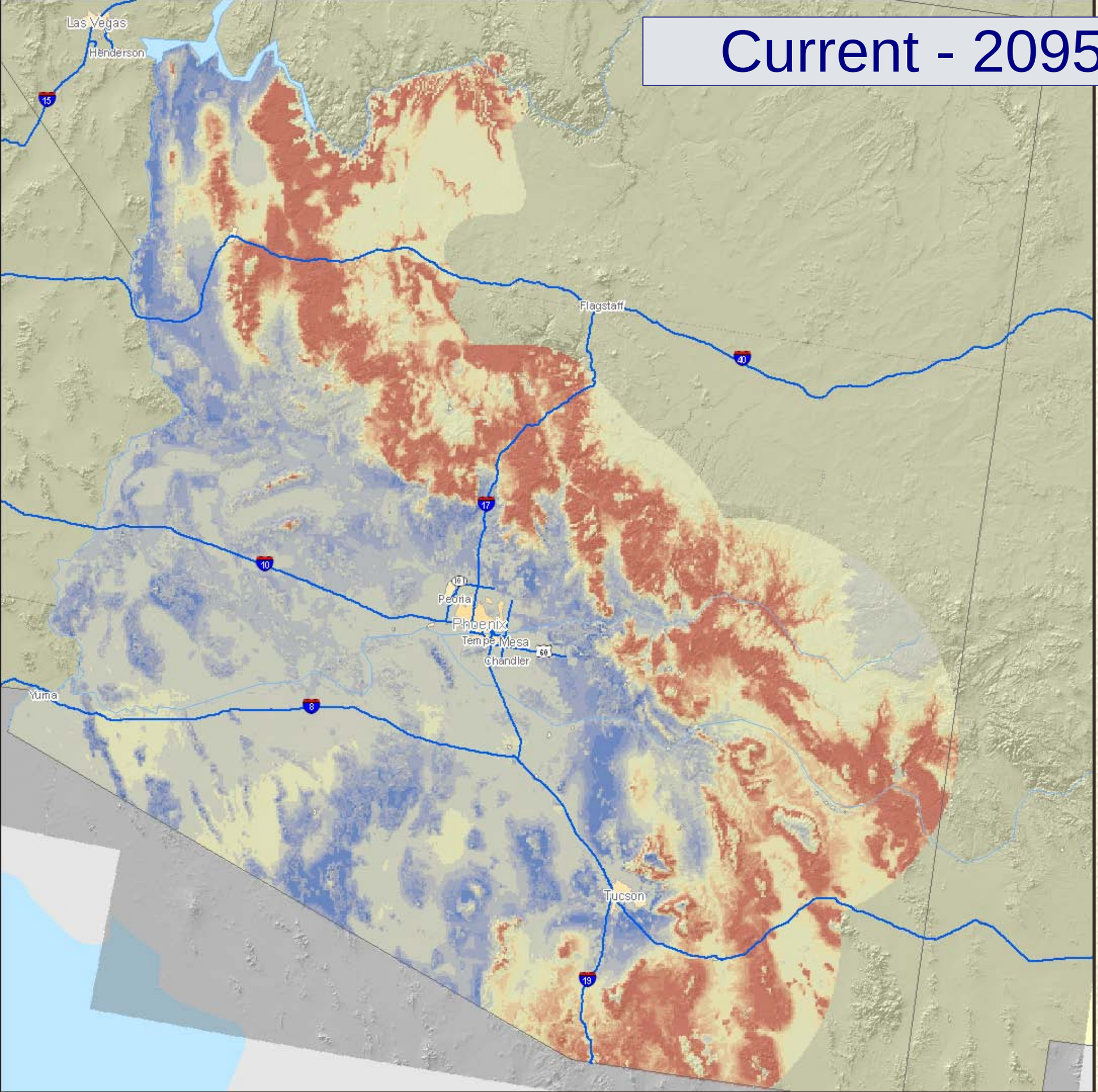
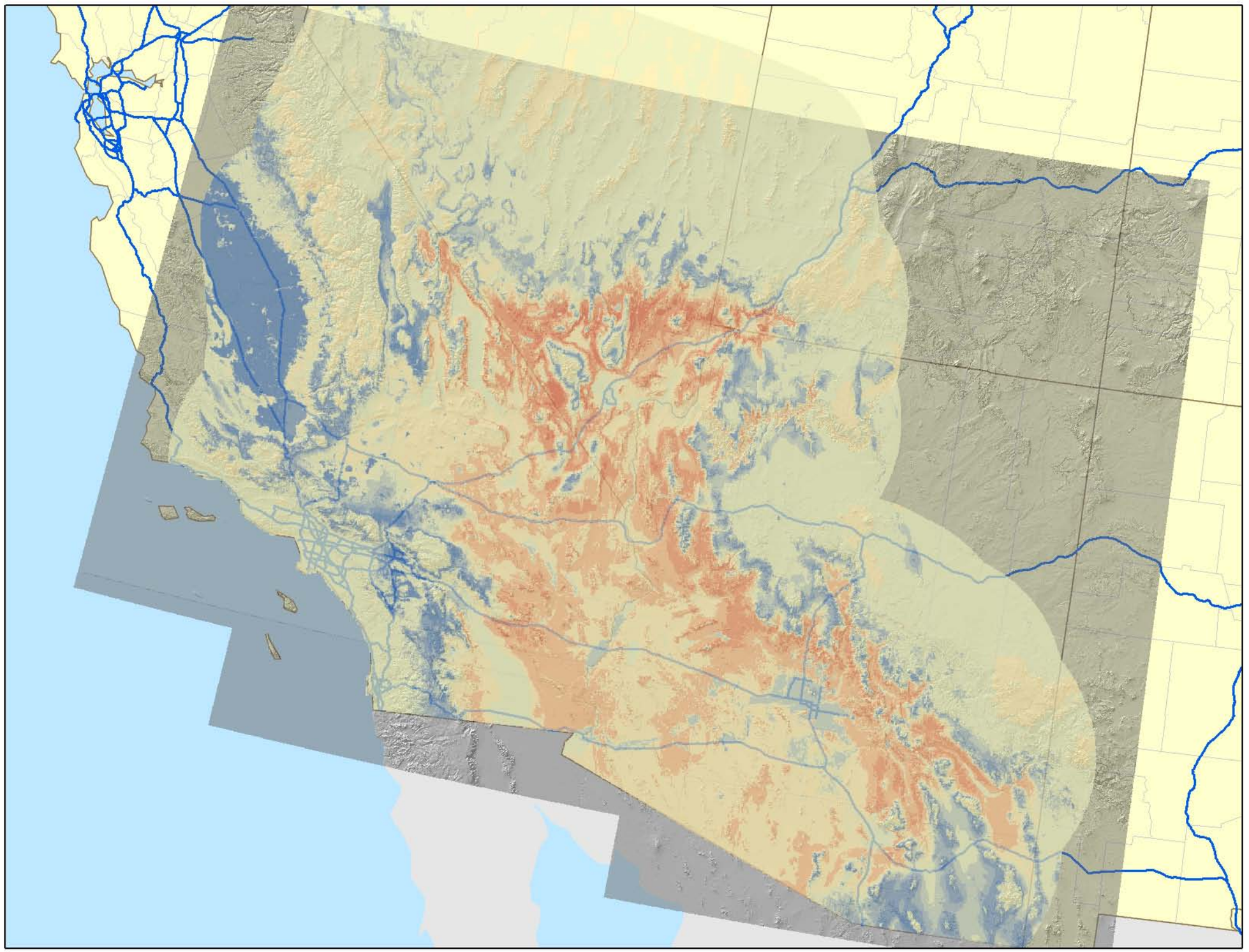
Tucson
19

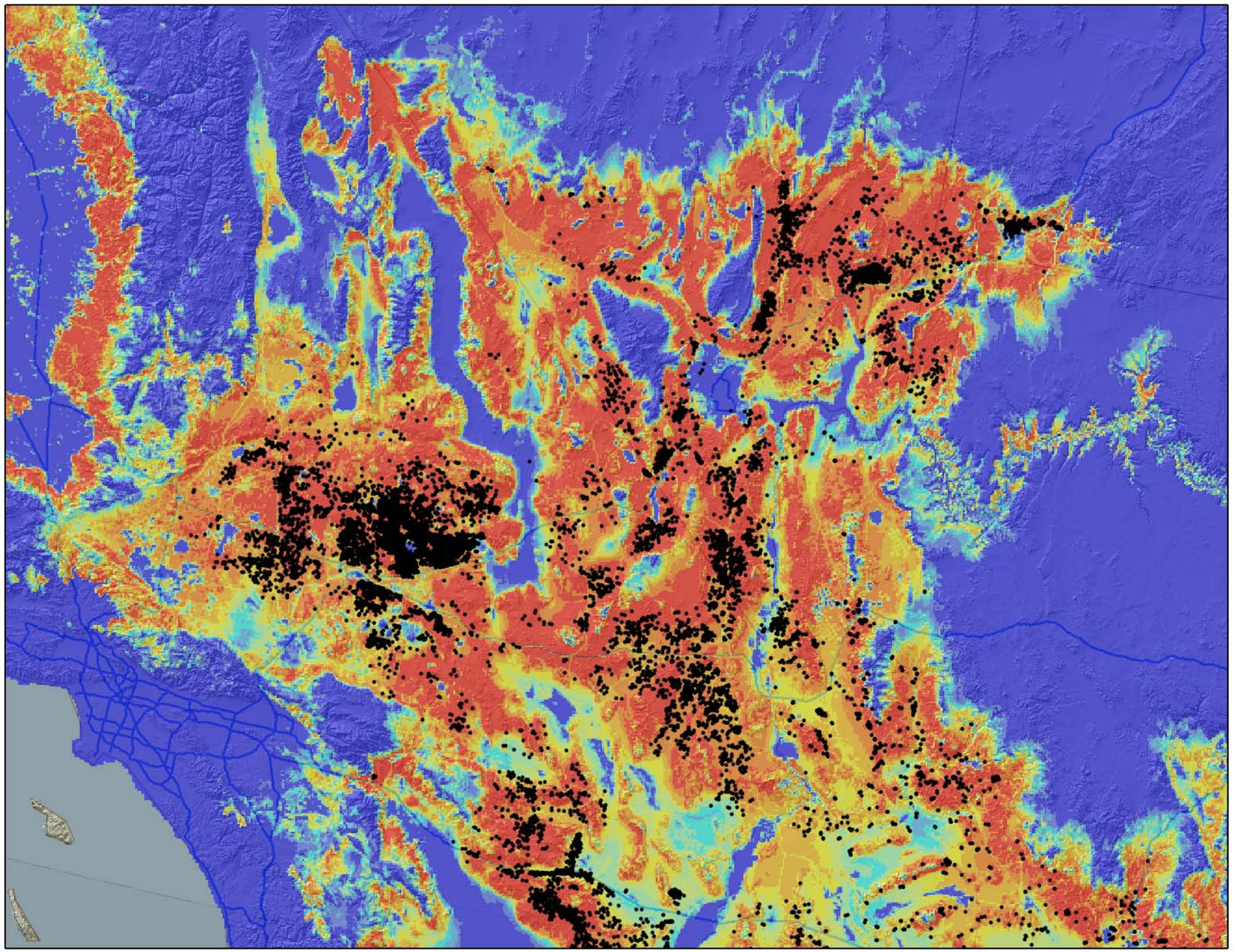
Current - 2095: RCP 8.5



Difference Map fl 2.5 and fl 8.5 - 2095

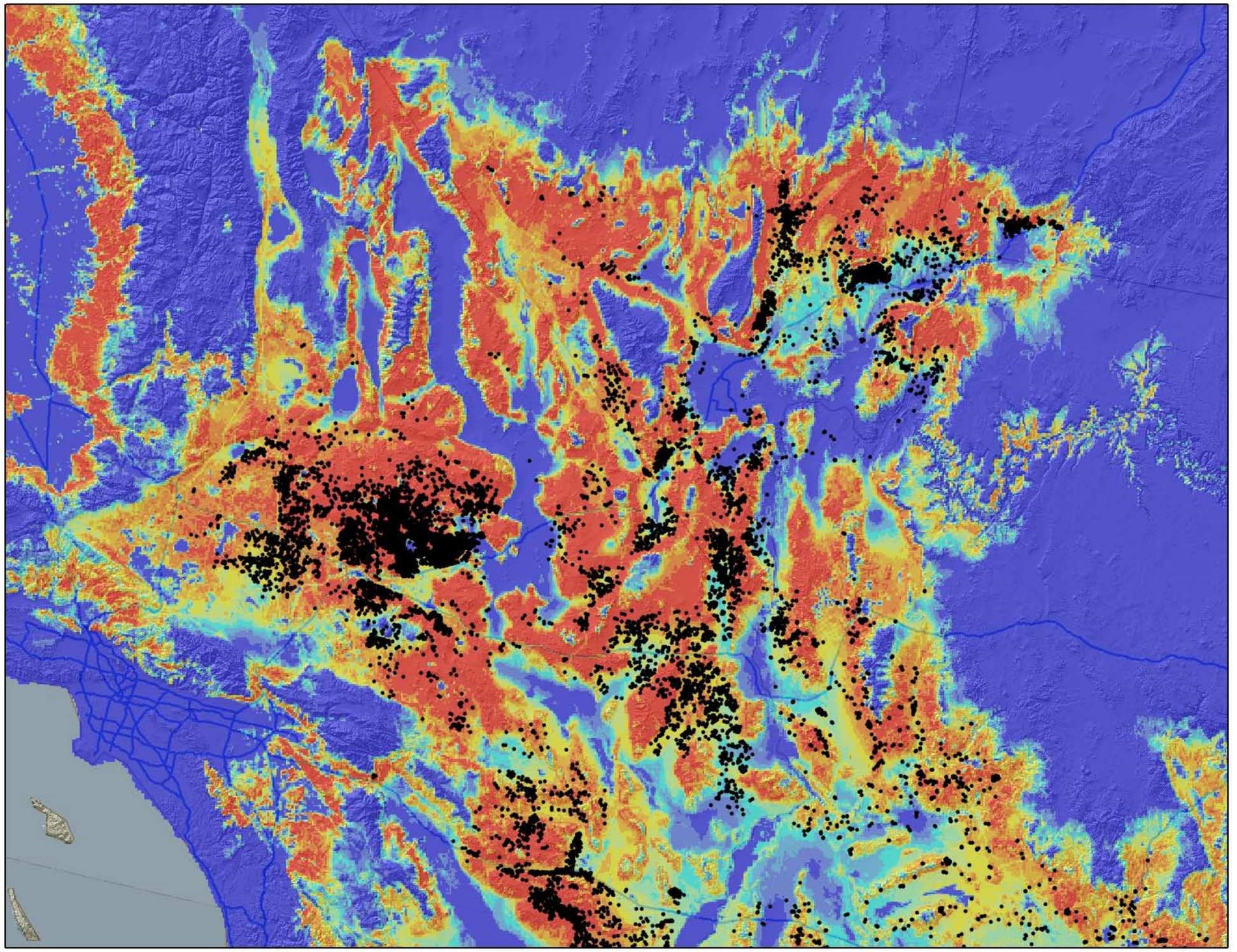


Habitat Model - 2040



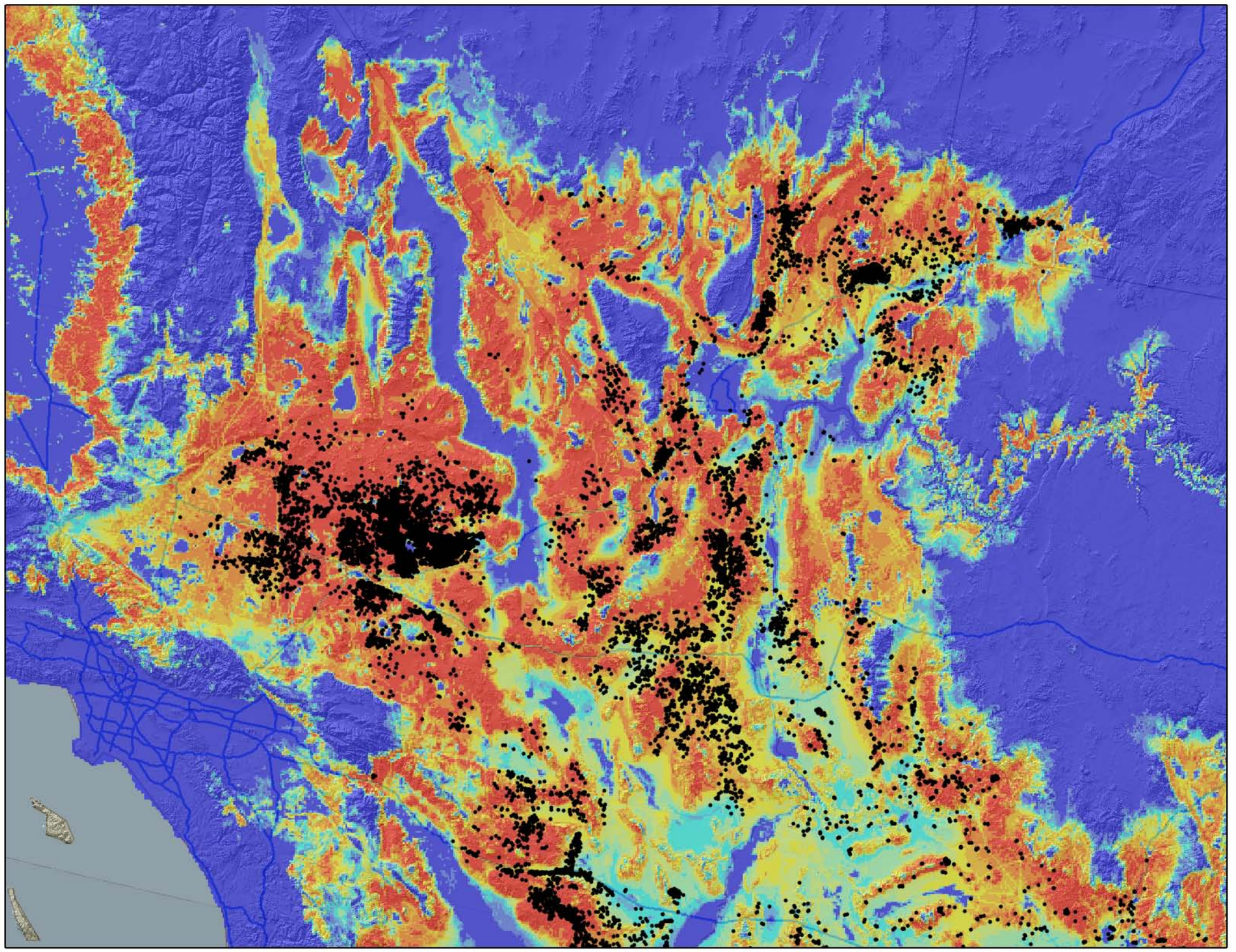
CMIP3 – Forcing level 2.5

Habitat Model - 2095



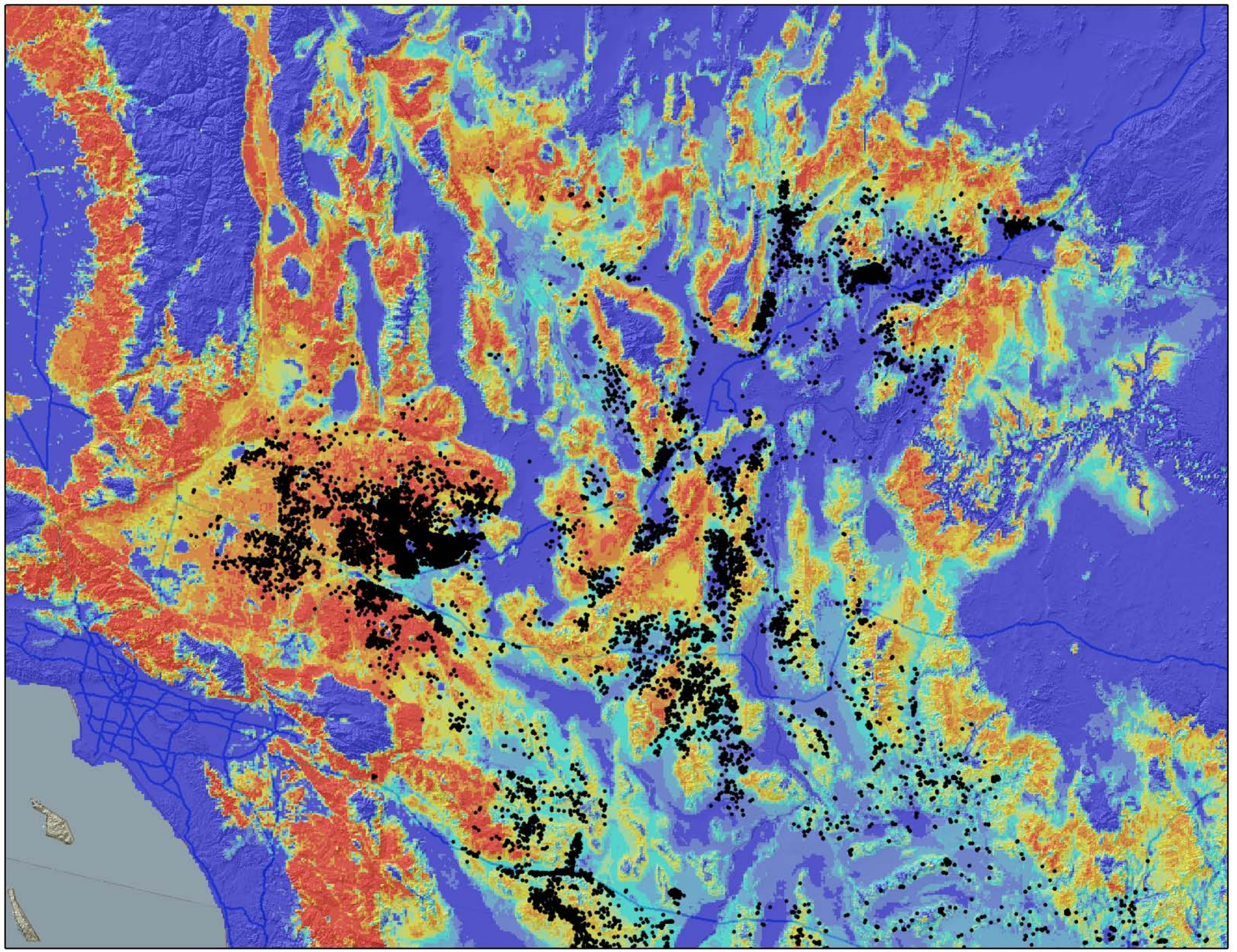
CMIP3 - Forcing level 2.5

Habitat Model - 2040



CMIP3 – Forcing level 8.5

Habitat Model - 2095



CMIP3 – Forcing level 2.5