SPECIES DISTRIBUTION MODELING FOR CLARK COUNTY PHASE II - 17 (18) ADDITIONAL SPECIES

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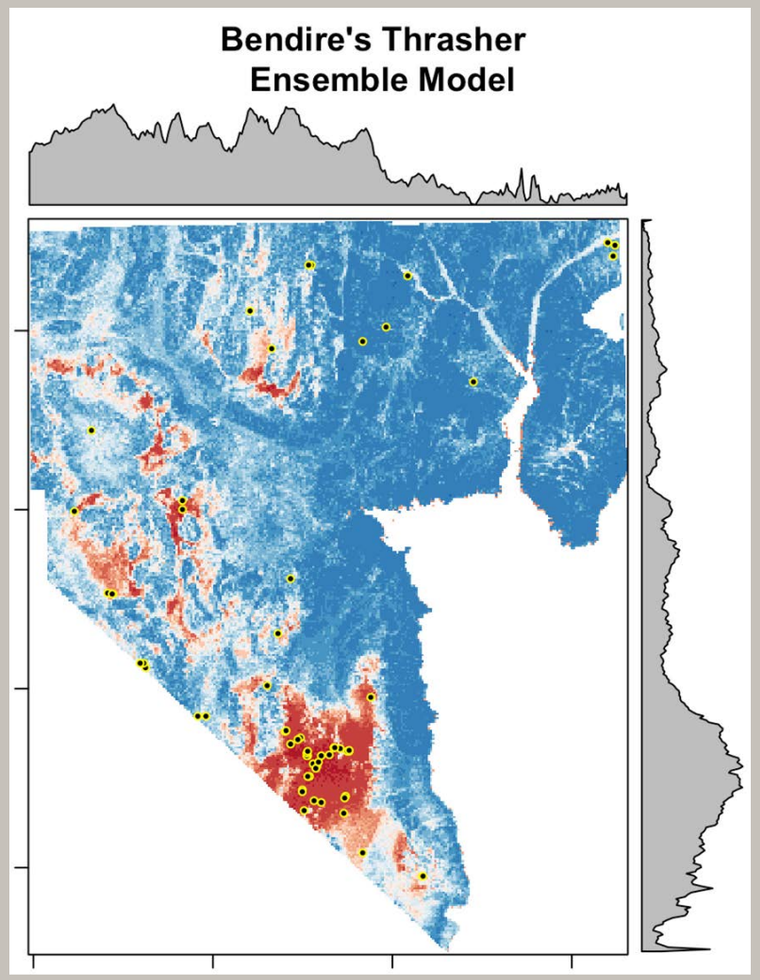
CLARK COUNTY GOALS FOR THIS PROJECT …



Clark County Needs

- Revising/updating the covered species list
  - Updated species accounts
  - Species distribution models (SDMs) to aid in identifying potential habitat
  - Recognizes that some models exist – but want an evaluation of their quality/utility

Phase I - Species Accounts and SDMs

- Review and Update 18 Existing Accounts
- Create 28 New Species Accounts
- Review 25 Existing Models
- Create 31 New SDMs

Phase II SDMs

- **Revisit Species Models (18) where the capacity exists to re-run them**
  - **Some species have more data available**
  - **Higher resolution is desired for some species**

SPECIES ADDRESSED

- **Desert tortoise (*Gopherus agassizii*)**
- **Loggerhead shrike (*Lanius ludovicianus*)**
- **LeConte's thrasher (*Toxostoma lecontei*)**
- **Gilded flicker (*Colaptes chrysoides*)**
- **Bendire's thrasher (*Toxostoma bendirei*)**
- **Southwestern willow flycatcher (*Empidonax traillii extimus*)**
- **Arizona Bell's vireo (*Vireo bellii arizonae*)**
- **Yellow-billed cuckoo (*Coccyzus americanus*)**
- **Ridgeway's rail (*Rallus obsoletus yumanensis*)**
- **Golden Eagle (*Aquila chrysaetos*)**
- **Desert pocket mouse (*Chaetodipus penicillatus*)**
- **Parish phacelia (*Phacelia parishii*)**
- **Pahrump Valley buckwheat (*Eriogonum bifurcatum*)**
- **Las Vegas buckwheat (*Eriogonum corymbosum* var. *nilesii*)**
- **White-margined beardtongue (*Penstemon albomarginatus*)**
- **Las Vegas bearpoppy (*Arctomecon californica*)**
- **Sticky ringstem (*Anulocaulis leiosolenus*)**
- **Sticky buckwheat (*Eriogonum viscidulum*)**

CONCEPTUAL MODEL

Climate Change

Temperature

Precipitation

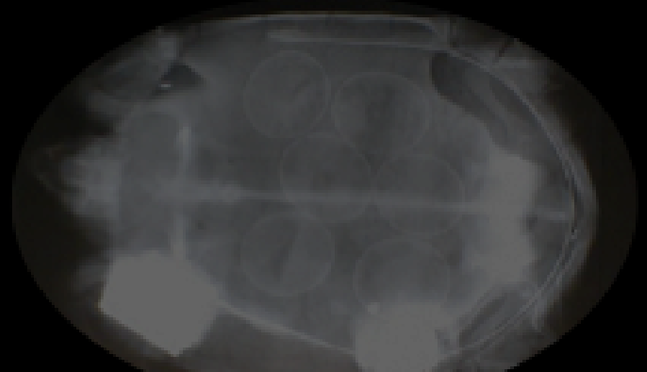
Activity

Create Conceptual model from the information in the Species Account

- Identifies appropriate scale and resolution for analysis
- Identifies key drivers for habitat/distribution
- Drives use and development of habitat layers needed as GIS, and expected statistical relationships

Number of Eggs

Annual Plants



Sex

Growth

CONCEPTUAL MODELS

Optimal habitat has been characterized as creosote bush scrub in which **precipitation ranges from 50 to 203 mm** (2 to 8 inches), where a diversity of perennial plants is relatively high, and **production of annual plants is high** (Luckenbach 1982; Turner 1994; Turner and Brown 1994). .....

Mojave Desert tortoises **do not occupy the seasonally submerged playas such as the Jean, or Eldorado dry lakes**. However, they are abundant in the broad valleys like those around Cal-Nev-Ari, Goodsprings, and Coyote Springs. Those areas have **deep soils of fine sandy-loam and gravels where tortoises dig their burrows**. Vegetation is creosotebush and white bursage shrublands where many other species of shrubs, grasses, cactus and a few trees occur. .....

Seasonal Greenup and Timing

Surface Texture

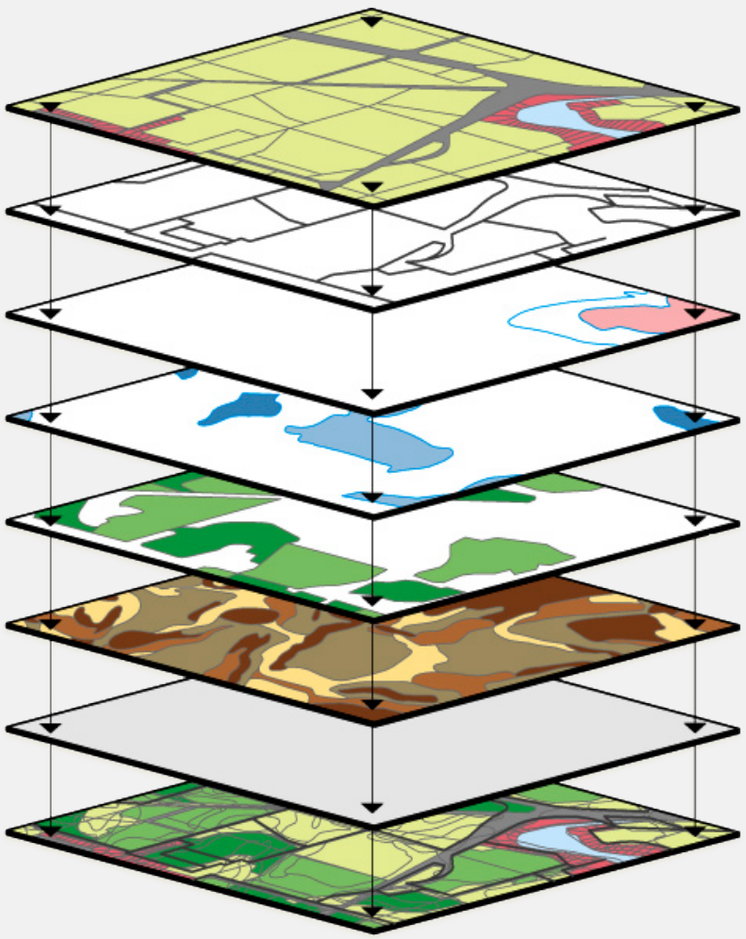
Soil Composition

Precipitation

Terrain Roughness

Temperatures (Winter Spring Summer)

ENVIRONMENTAL LAYERS



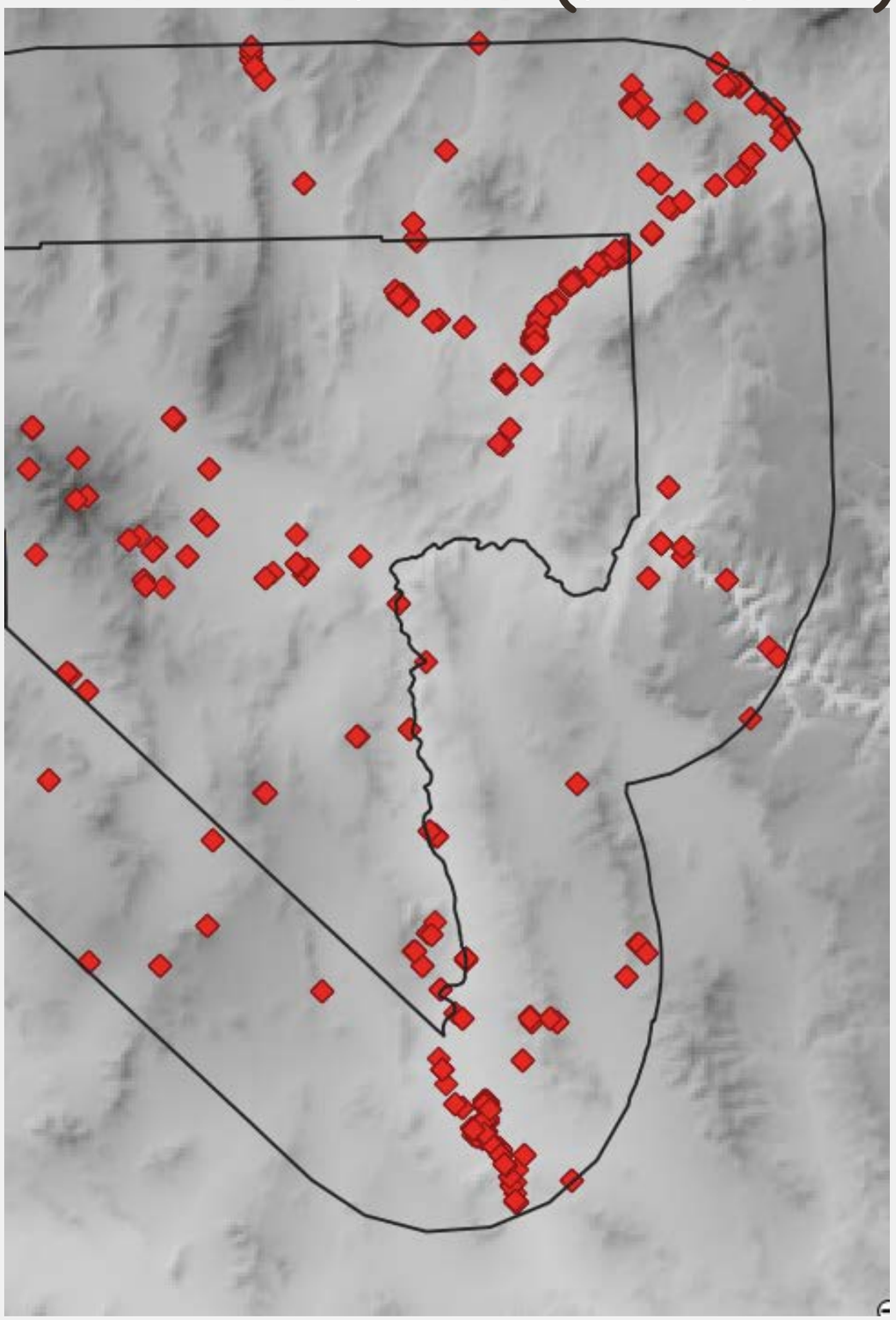
Acquire, and Create environmental layers

- Layers that we have developed from previous efforts
- Online sources (DataBasin, ESRI, USGS National Map, National Land Cover Database, NRCS, etc.)
- Generation of new layers if needed
  - E.g. Aggregated PRISM information for different temporal periods

LOCALITY DATA

- County provided sources (BLM, NDOW, CCDCP, …)
- Searches of online sources (herpnet, vertnet, i-naturalist, ebird, NNHP, and other museum sources)
- Colleagues and scientific literature with species specific information

Bell's Vireo (N = 630)



ASSESS DATA QUALITY

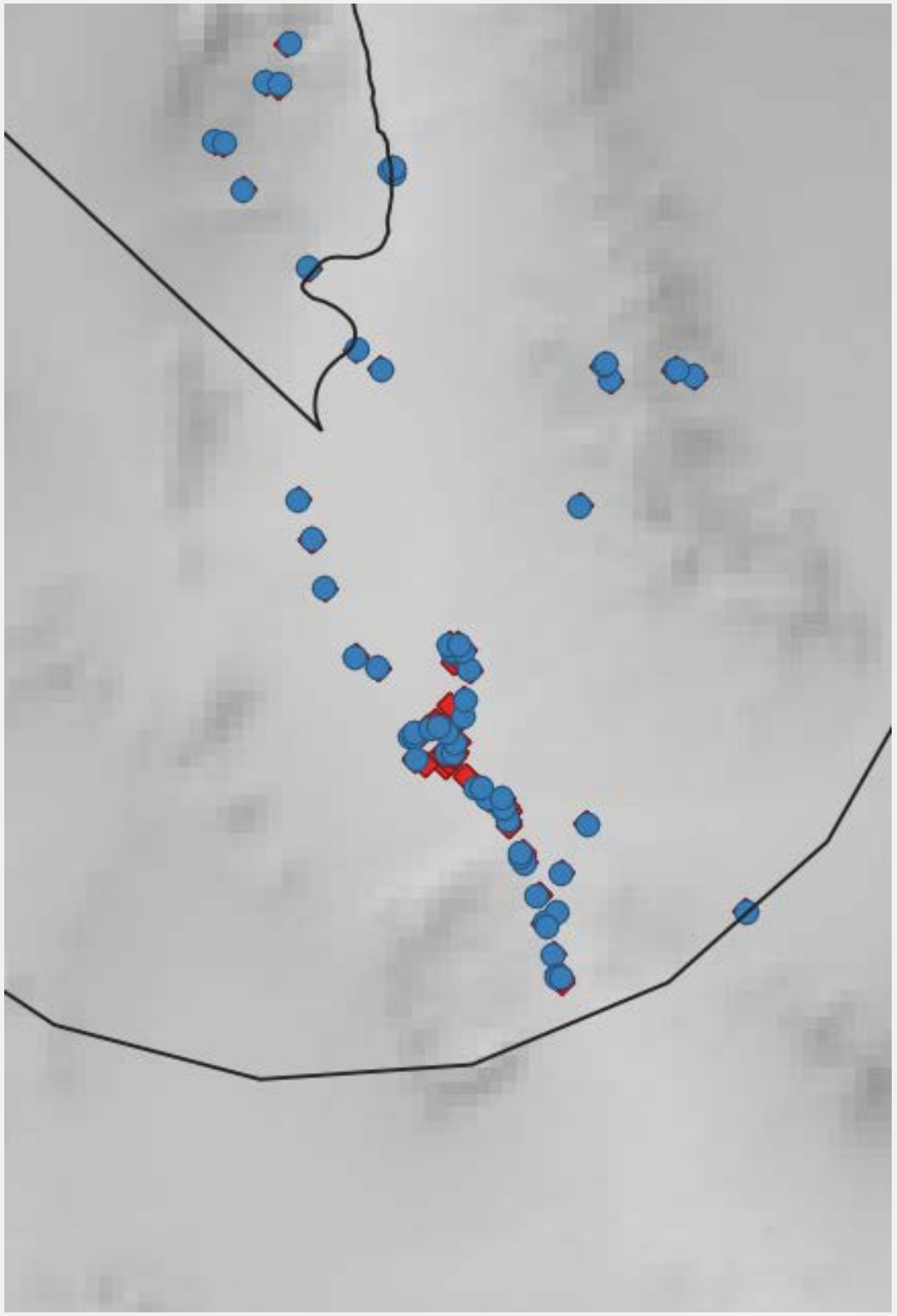
QAQC Species and Environmental Data

Evaluate spatial accuracy and precision of input data relative to species modeling goals (e.g. resolution)

Evaluate completeness of data relative to range that species will be modeled over

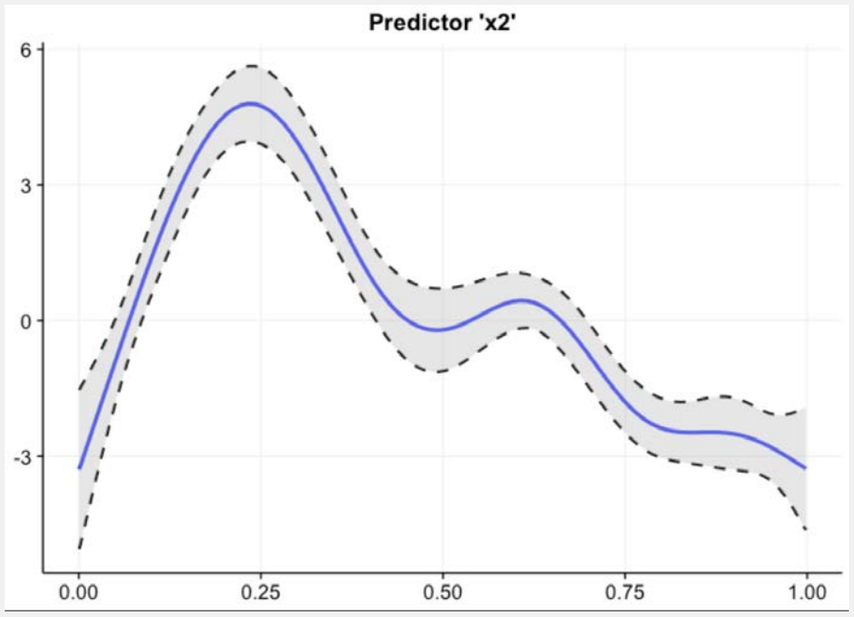
Evaluate patchiness of species data

Spatial Thinning of biased point data

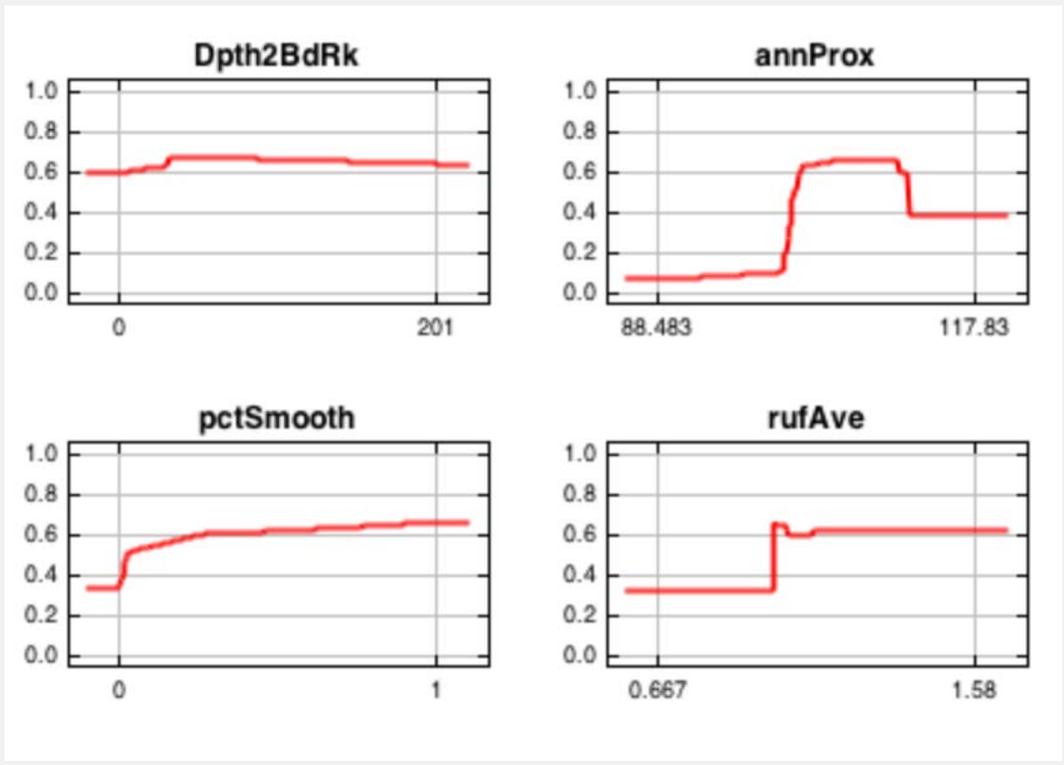


MODELING ALGORITHMS USED IN THIS STUDY

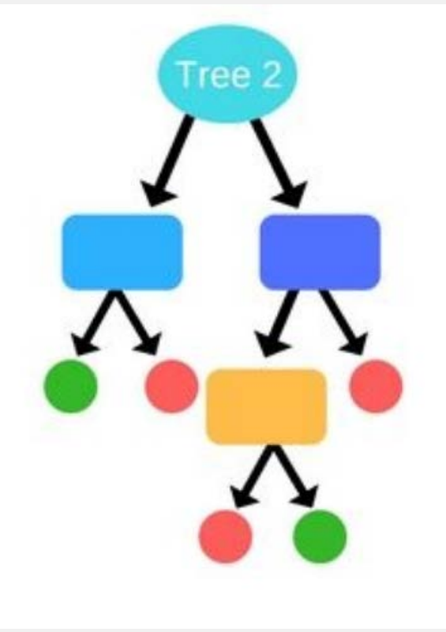
General Additive Models (GAM)



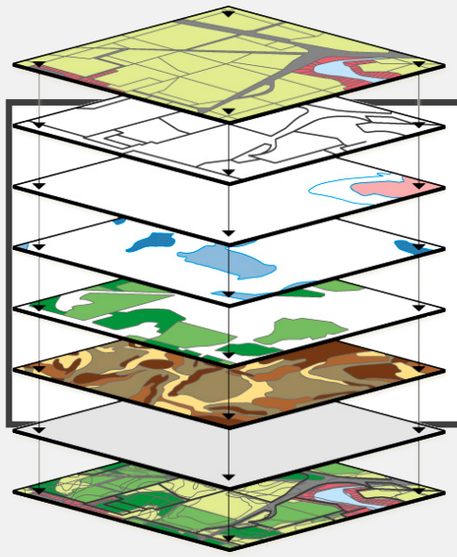
MaxEnt



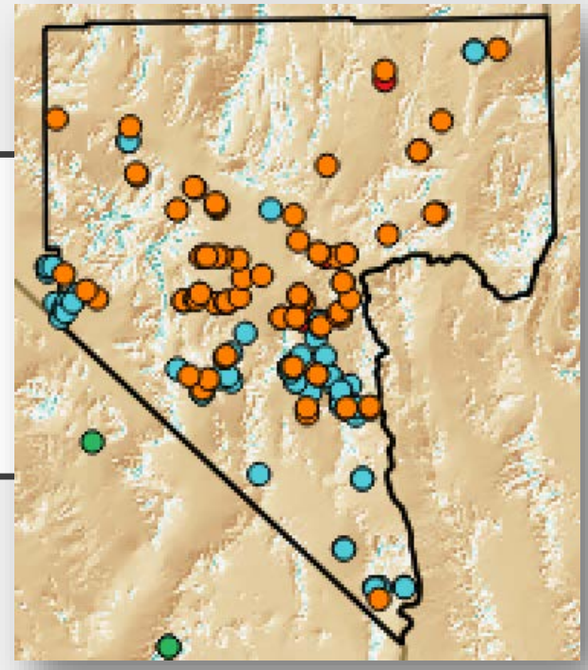
Random Forest



Ensemble Model = combination of the above



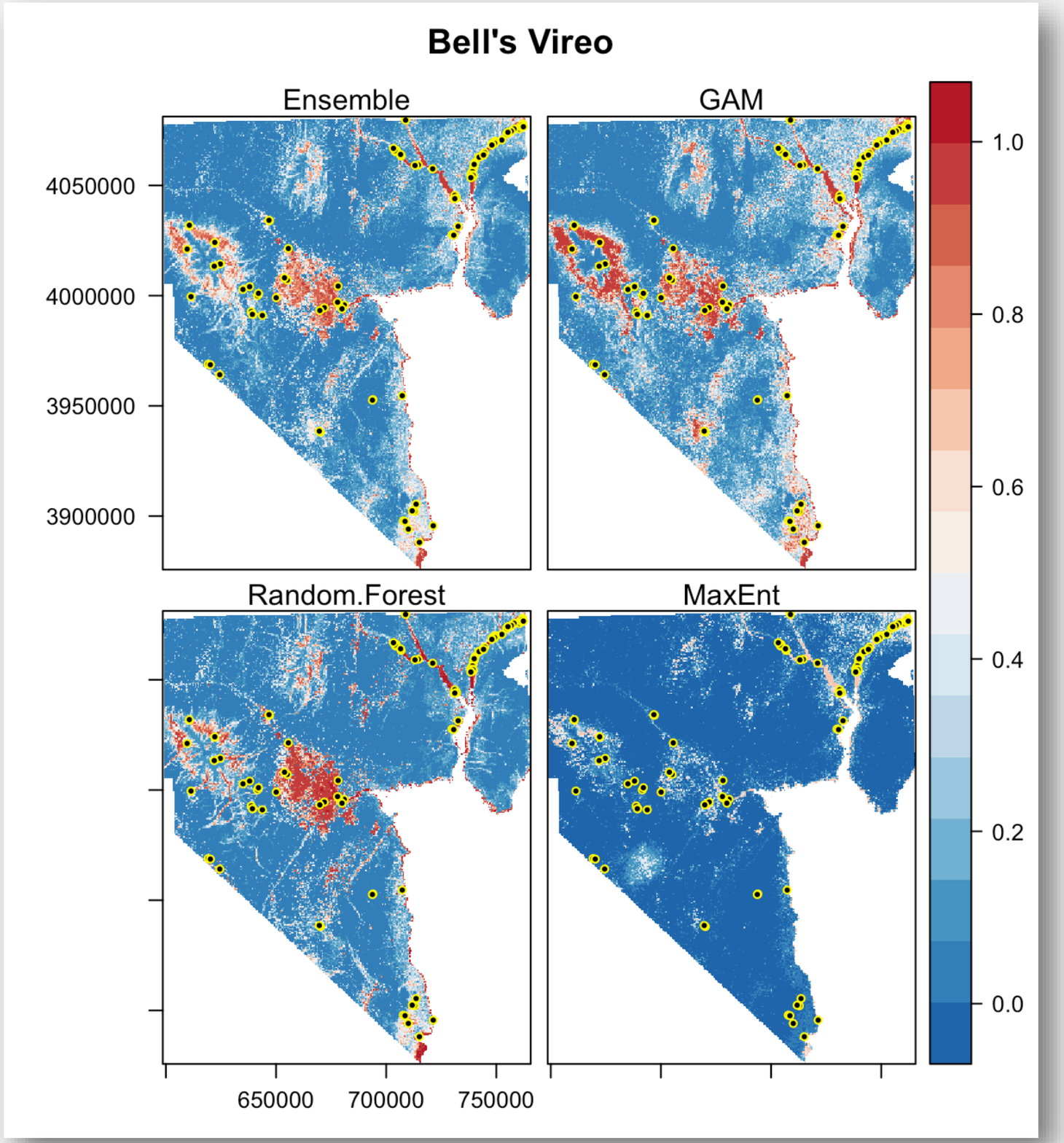
MODELING METHODS



- Cross-validation using an 50 sample (80:20 split) of localities and constrained Pseudo Absence Data
- Model combinations of up to 10 environmental layers
- Rank Models using AIC, AUC, BI, TSS as measured on an independent testing set
- Weighted Average pf the top models among algorithms to create an **Ensemble model**

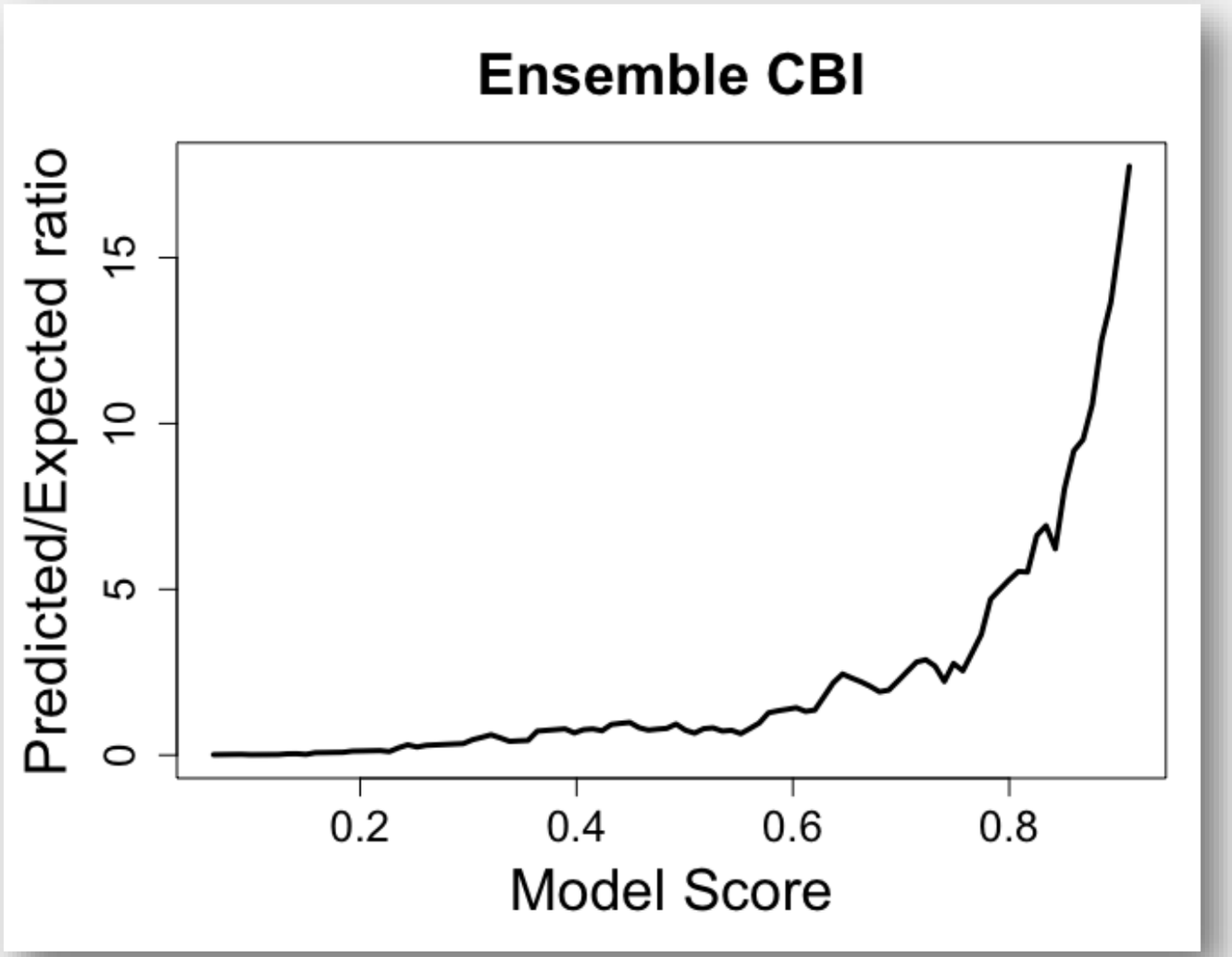
Ensemble

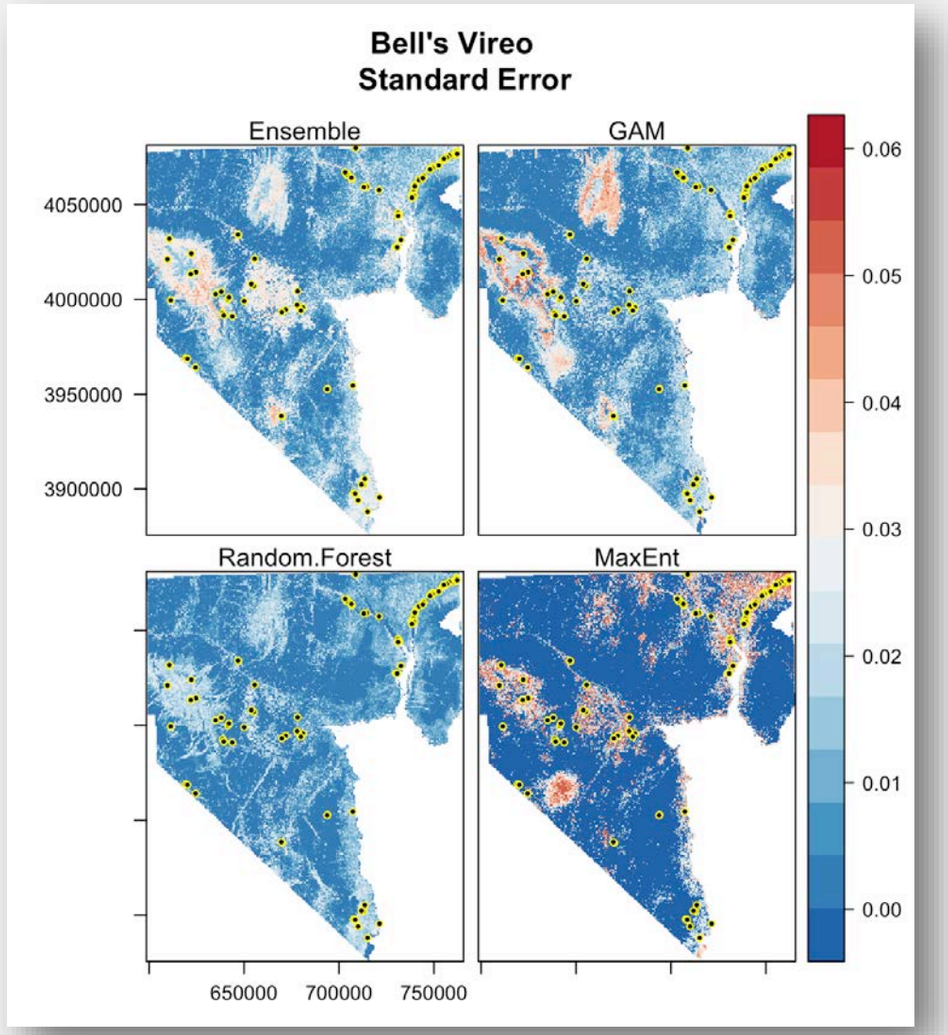
ENSEMBLING IS BENEFICIAL DUE TO GENERAL DIFFERENCES AMONG ALGORITHMS

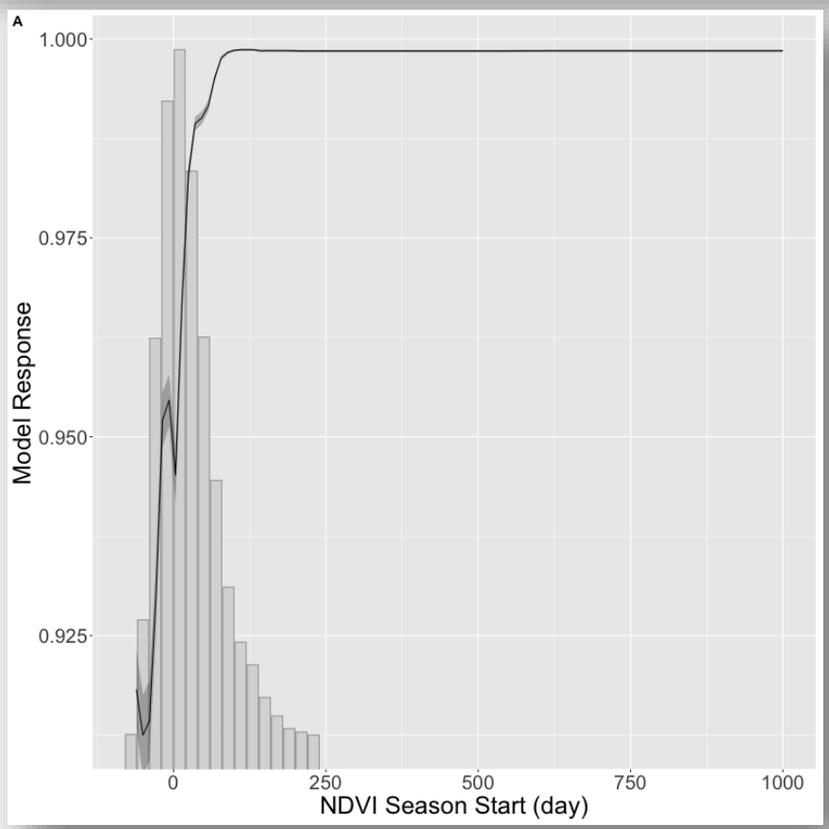


MODEL ASSESSMENT

Evaluate spatial accuracy and precision of model predictions with Standard Error Maps, and Continuous Boyce Indices



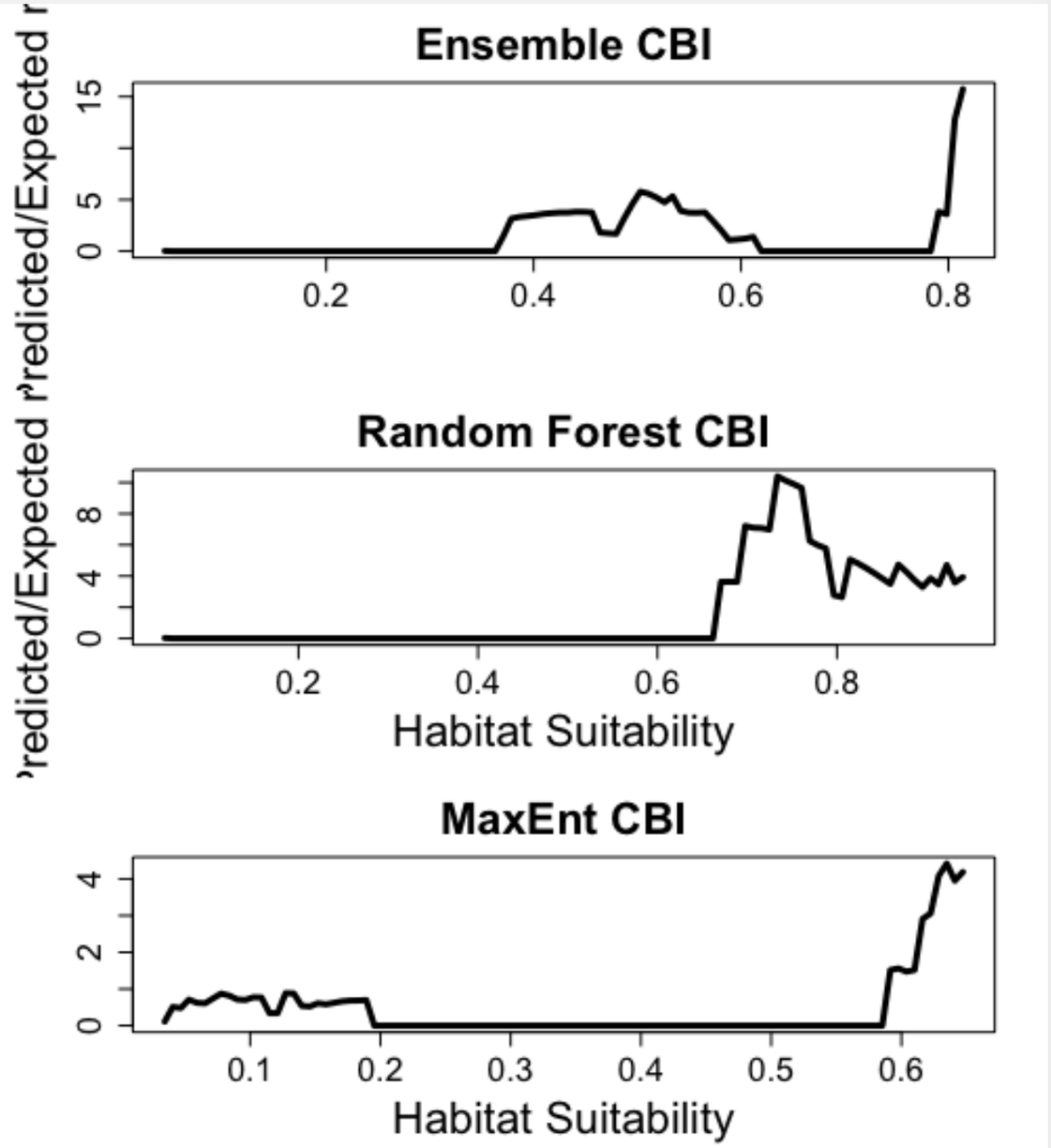


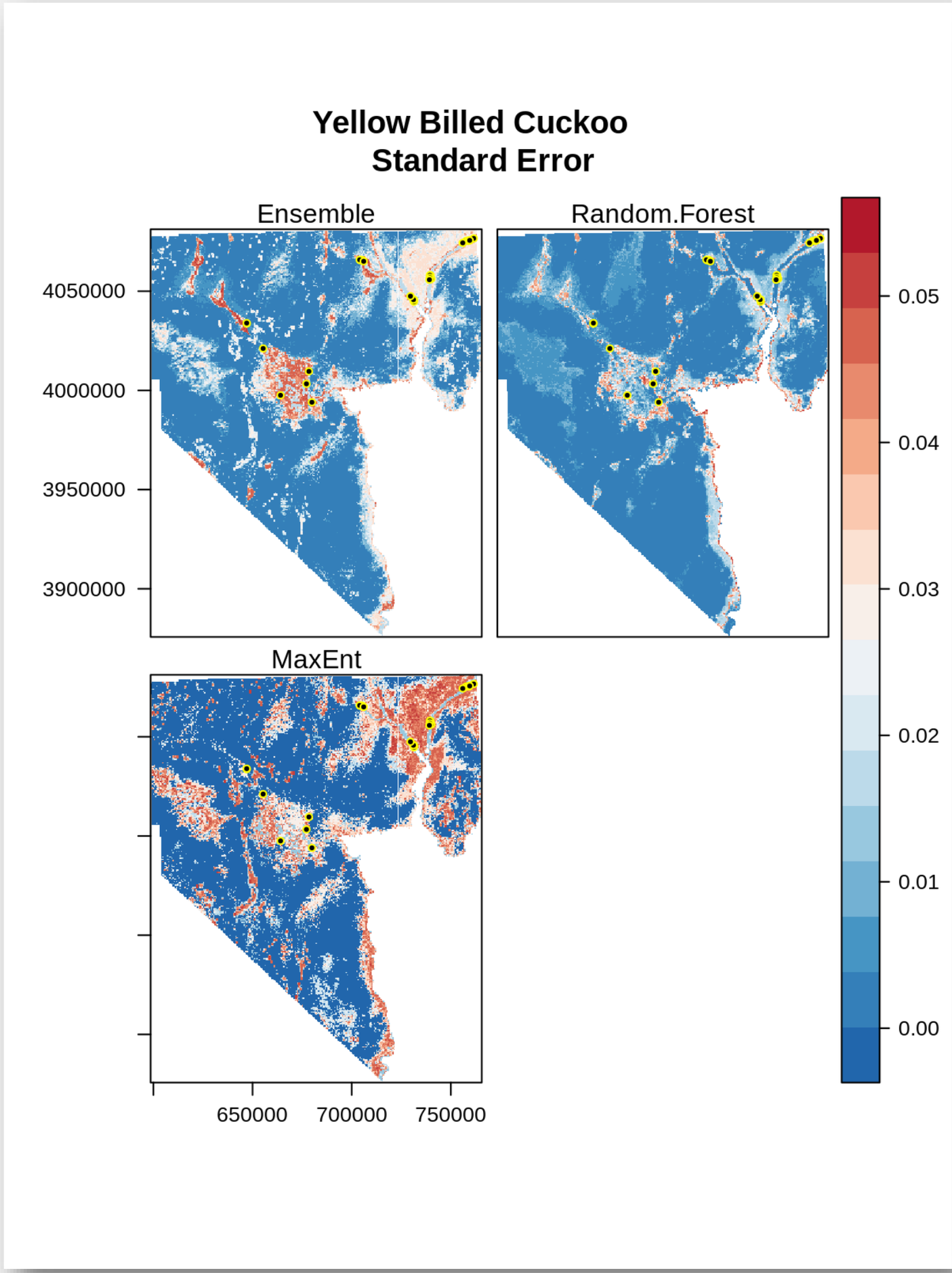


Species	Points
Desert tortoise (Gopherus agassizii)	3478
Loggerhead shrike (Lanius ludovicianus)	1570
LeConte's thrasher (Toxostoma lecontei)	388
Gilded flicker (Colaptes chrysoides)	127
Bendire's thrasher (Toxostoma bendirei)	208
Southwestern willow flycatcher (Empidonax traillii extimus)	239
Arizona Bell's vireo (Vireo bellii arizonae)	258
Yellow-billed cuckoo (Coccyzus americanus)	48
Ridgeway's rail (Rallus obsoletus yumanensis)	47
Golden Eagle (Aquila chrysaetos)	220
Desert pocket mouse (Chaetodipus penicillatus)	66
Parish phacelia (Phacelia parishii)	
Pahrump Valley buckwheat (Eriogonum bifurcatum)	
Las Vegas buckwheat (Eriogonum corymbosum var. nilesii)	
White-margined beardtongue (Penstemon albomarginatus)	
Las Vegas bearpoppy (Arctomecon californica)	
Sticky ringstem (Anulocaulis leiosolenus)	
Sticky buckwheat (Eriogonum viscidulum)	

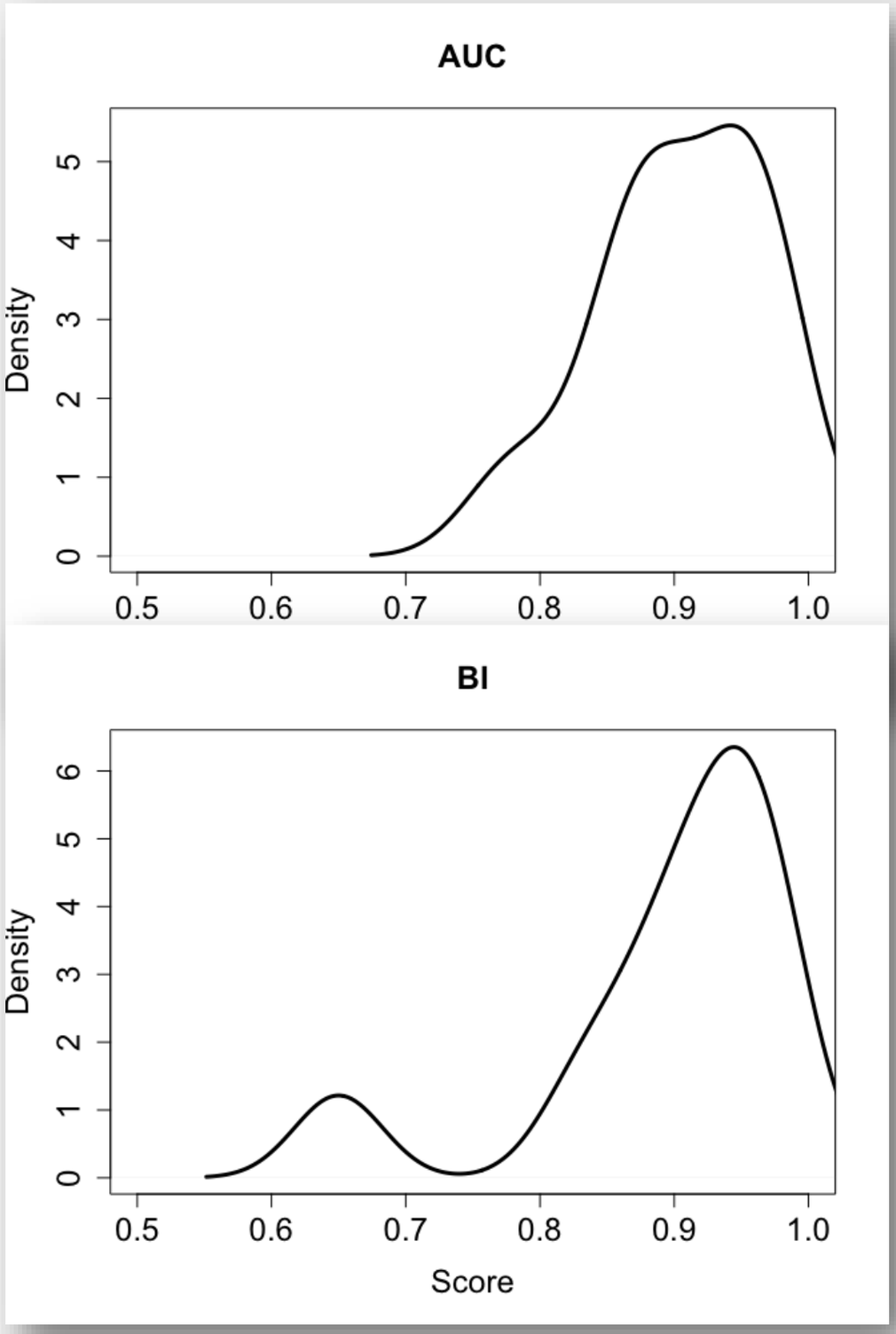
MODEL LOCALITIES

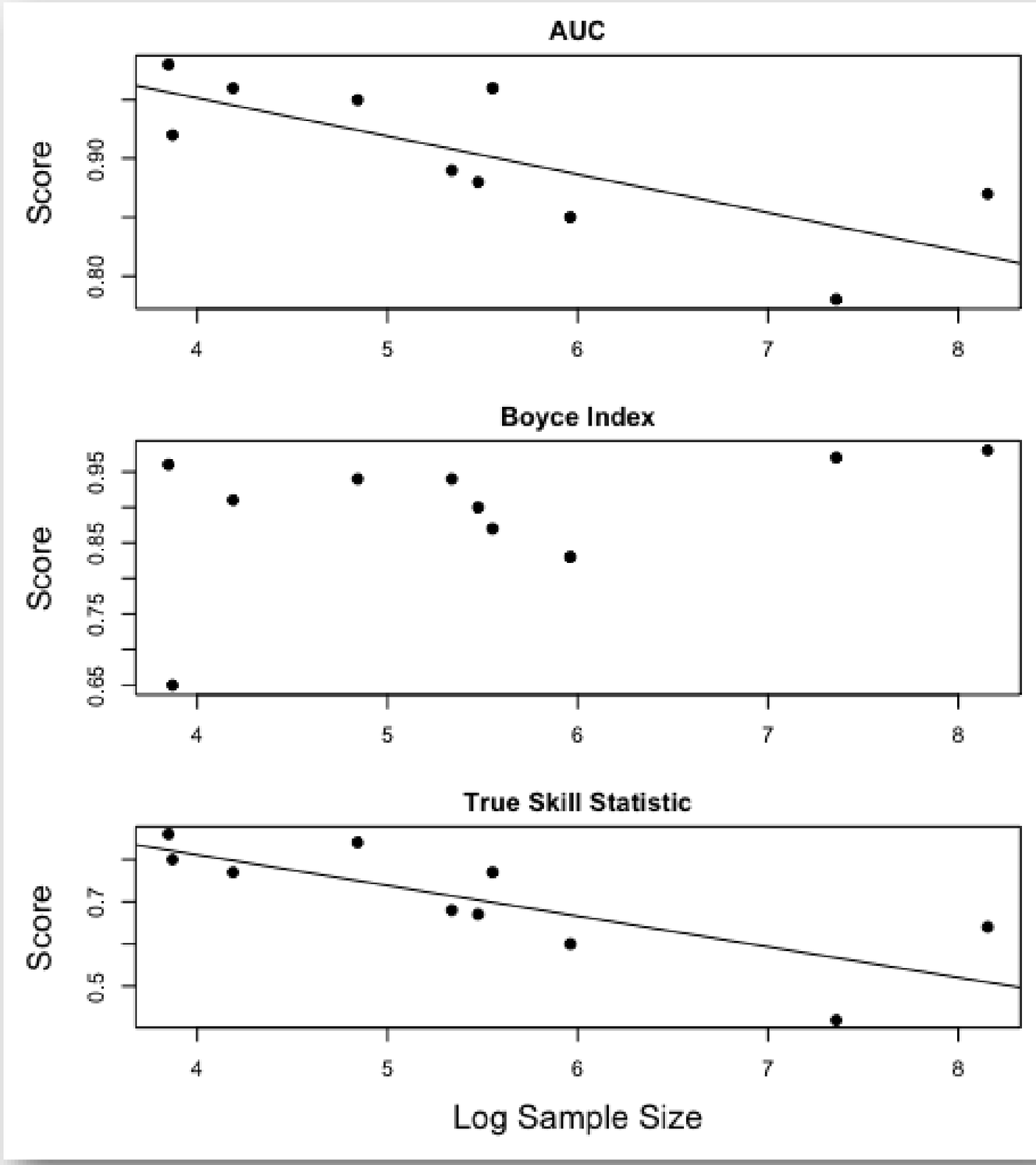
TOO FEW?


Predicted/Expected r
Ensemble CBI
0
5
15
0.2
0.4
0.6
0.8
Random Forest CBI
0
4
8
0.2
0.4
0.6
0.8
Habitat Suitability
MaxEnt CBI
0
2
4
0.1
0.2
0.3
0.4
0.5
0.6
Habitat Suitability

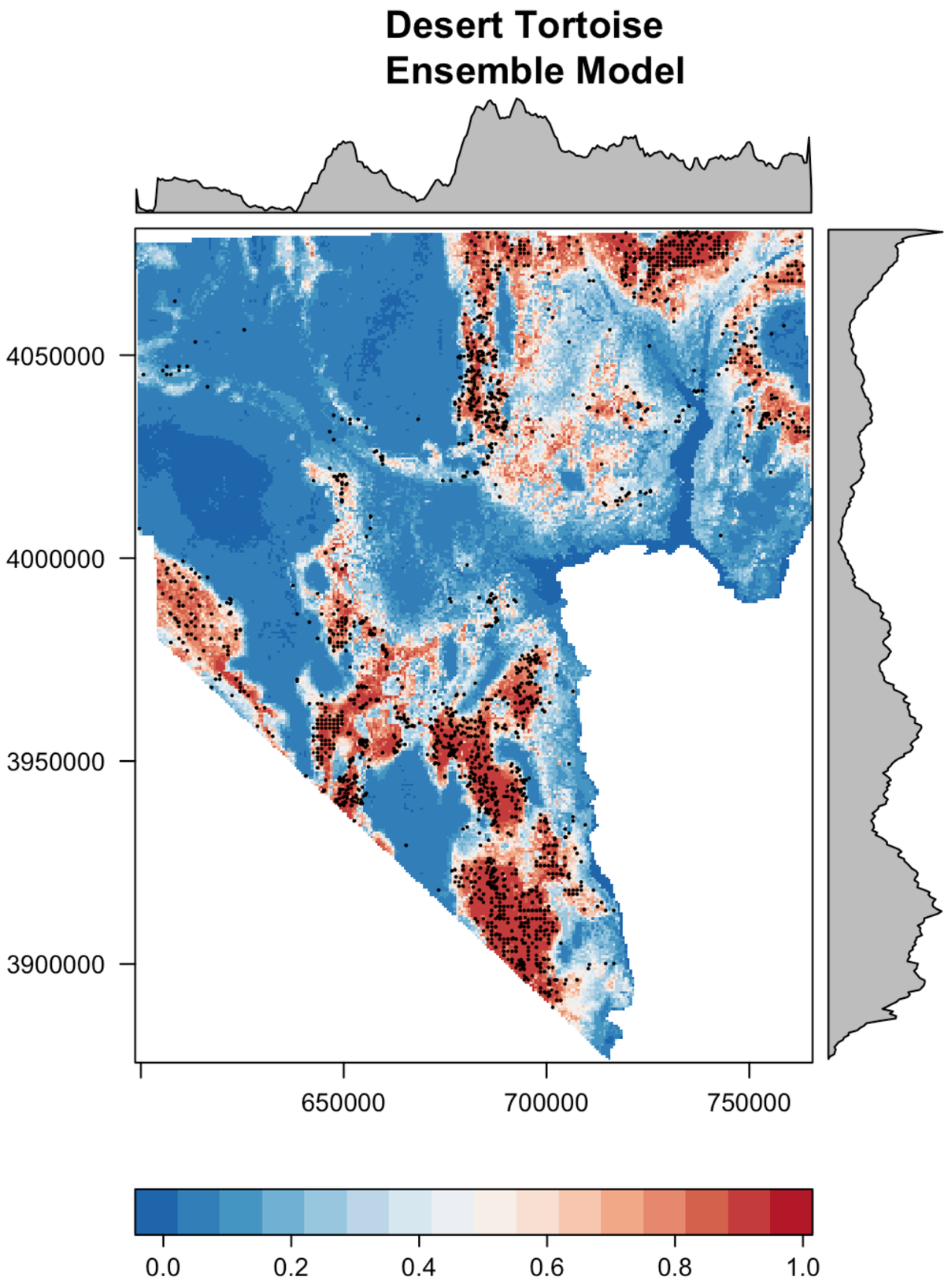

Yellow Billed Cuckoo
Standard Error
Ensemble
Random.Forest
MaxEnt
4050000
4000000
3950000
3900000
650000
700000
750000
0.05
0.04
0.03
0.02
0.01
0.00

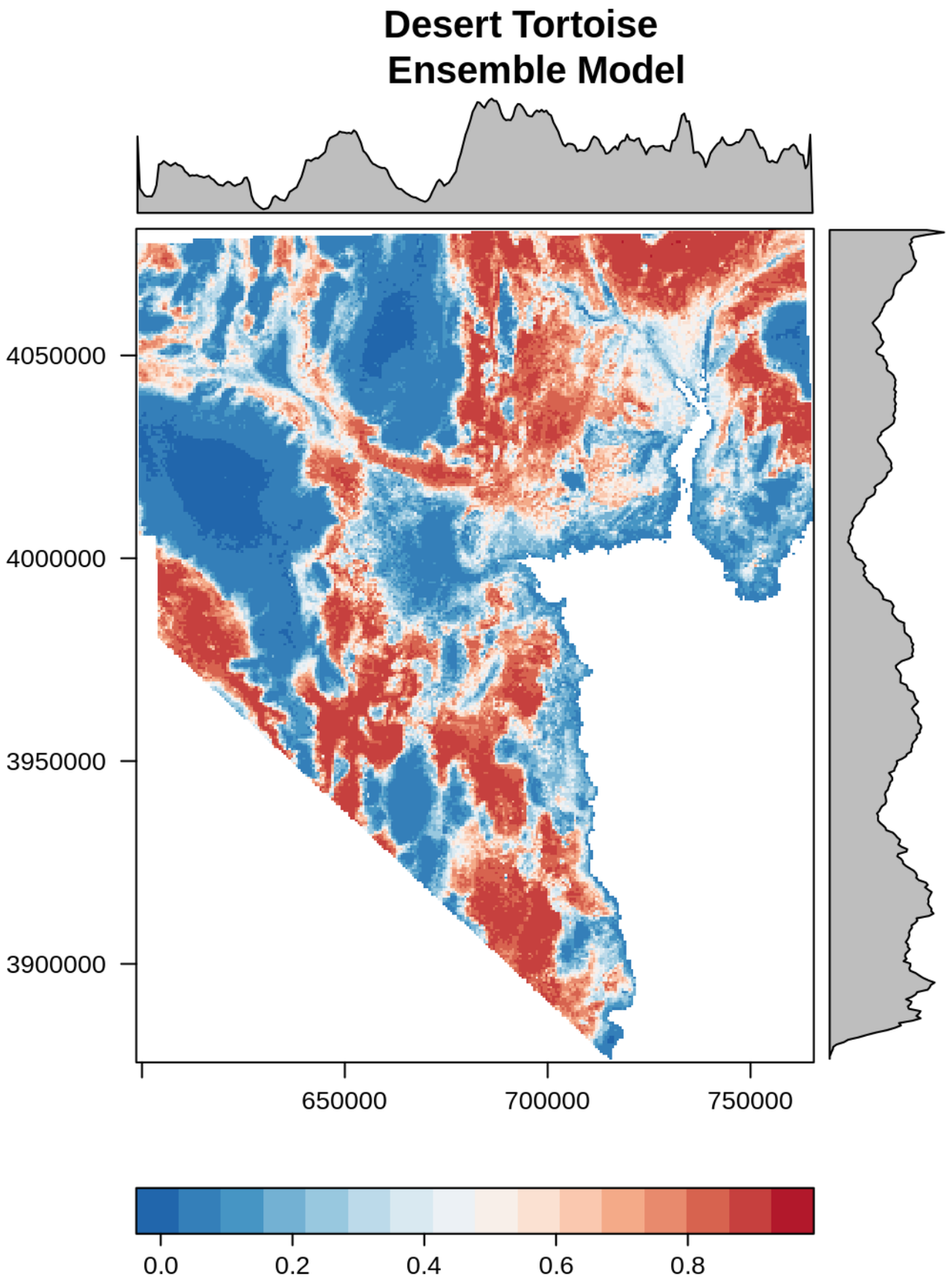
PERFORMANCE VS. SAMPLE SIZE





PLENTY – BUT BIASED?





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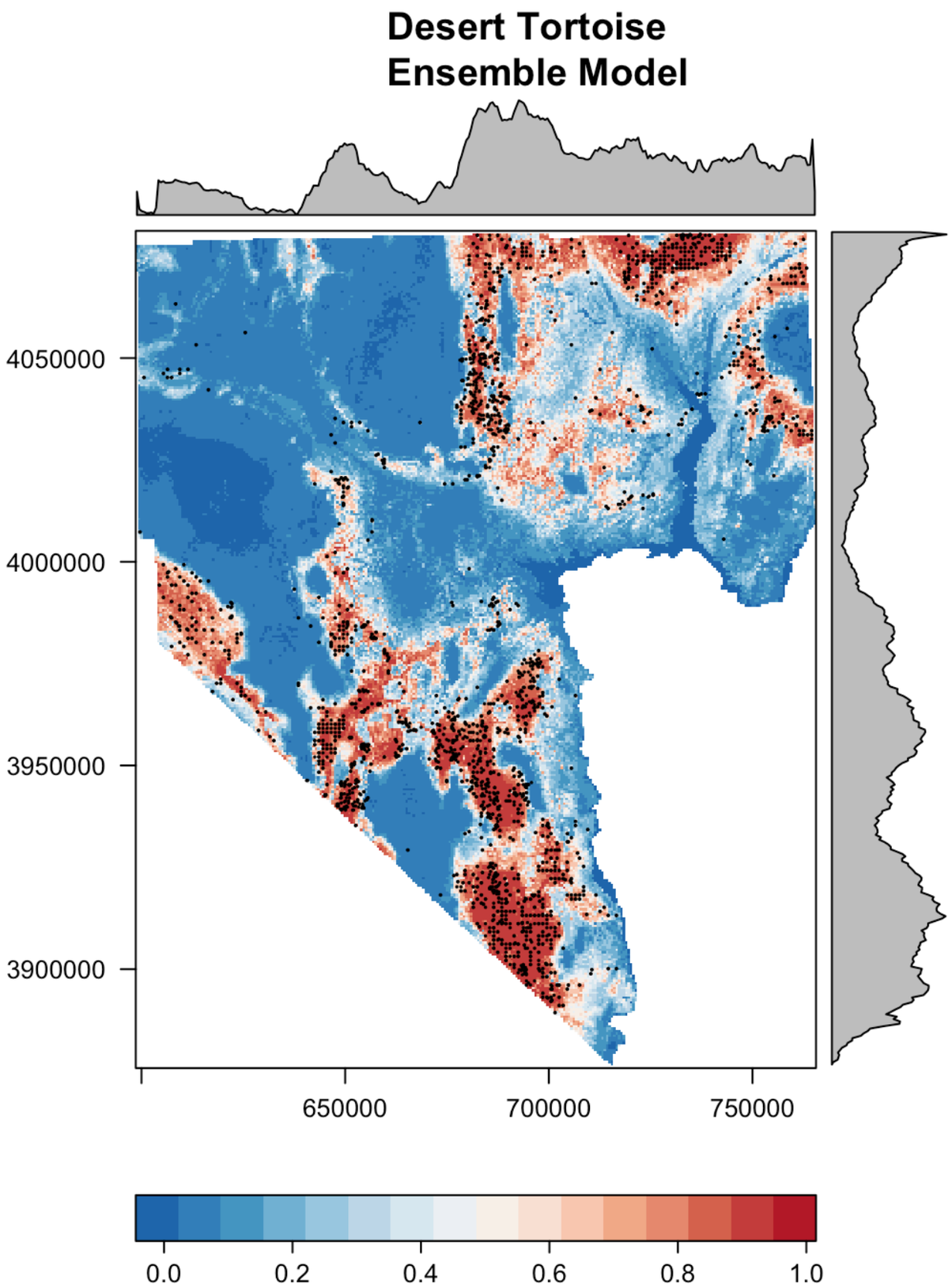

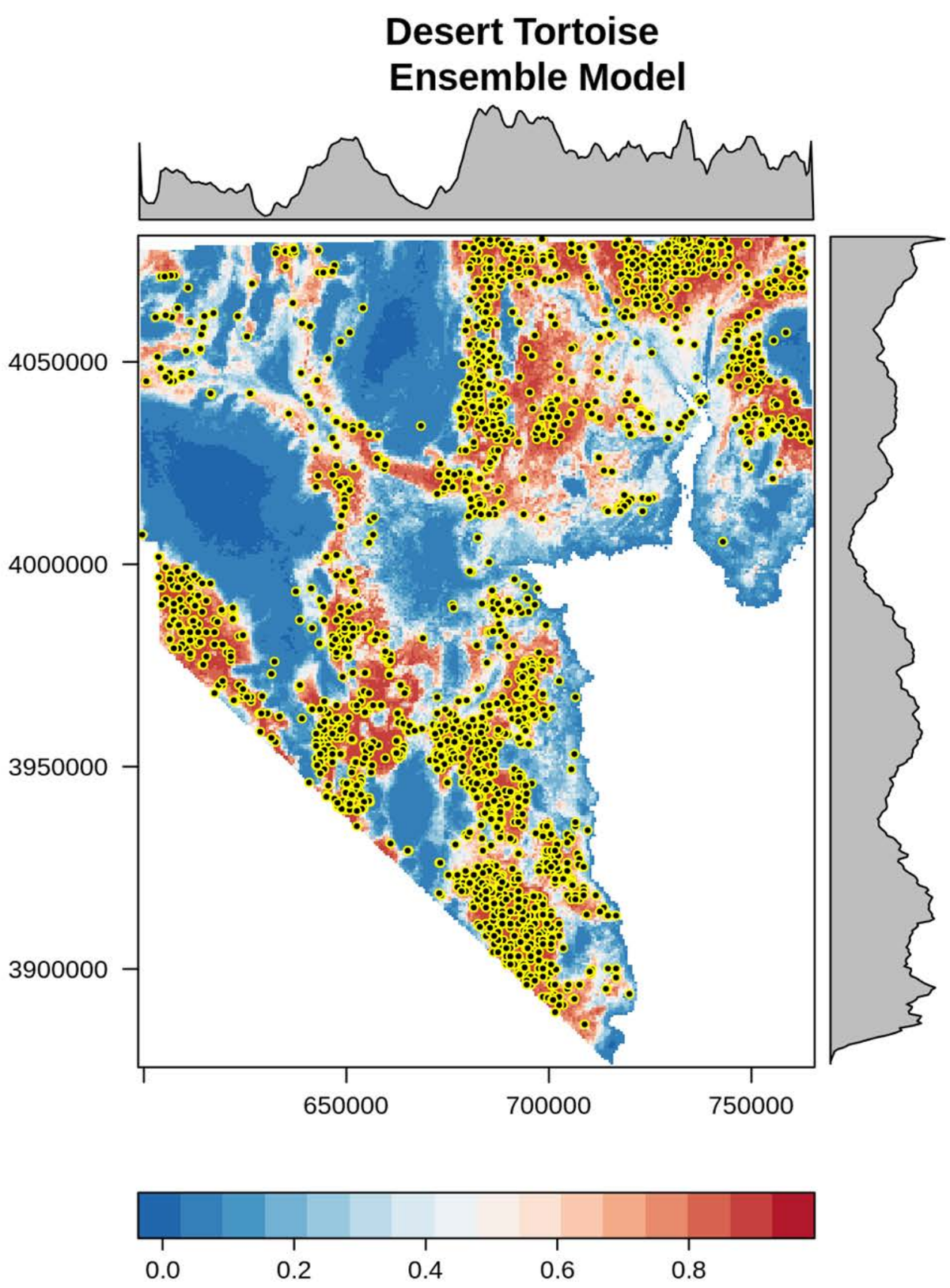

PROGRESS 4 MONTHS

18 Species of Plants and Animals

- 1st two Deliverables comprising 10 species have been submitted
- DT Model re-done
- Three species from final deliverable completed
  - 5 More *in Progress*