

Icelandic Rock Ptarmigan Species Distribution Model

Stefano Fochesatto

Icelandic Rock Ptarmigan Species Distribution Model

- Using occurrence data to model Icelandic Rock Ptarmigan species distribution.
- These nationwide models are a first step for making science based decisions with respect to conservation management.
- Wildlife-livestock conflict and ecosystem degradation.

The Data

- Study put together through several Icelandic environmental agencies, in conjunction with the University of Iceland and the UAF Institute of Arctic Biology.
- Nationwide and long term (1860-2021) Rock ptarmigan occurrence data (GBIF).
- Separate occurrence data from the Icelandic Institute of Natural History (2005-2010) for model validation.
- 11 Environmental Layers (May, June, July of 2021).

- None of the environmental layers showed correlation above .75 (multicollinearity).
- Environmental layers consisted of:
 - Three categorical variables: land cover classes, soil types, wilderness.
 - Eight continuous variables: elevation, distance fenced pastures, distance to (inland) water, Normalized Difference Vegetation Index (NDVI), slope, and average precipitation, temperature and wind speed for June, July and August.

The Data

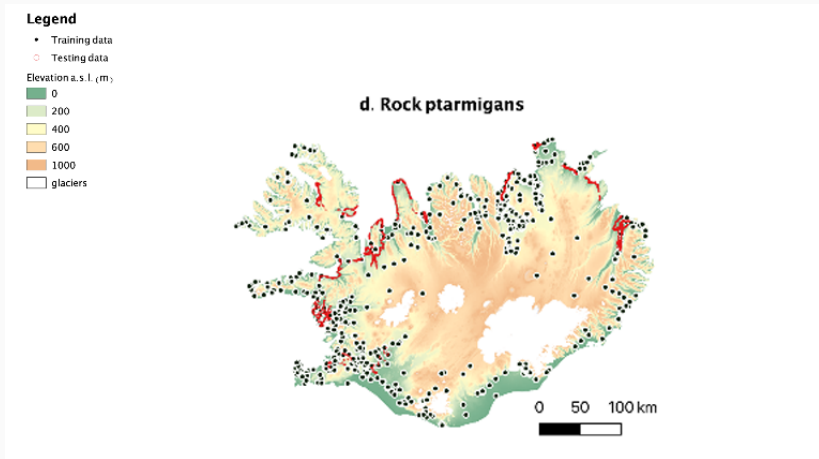


Figure 1: Predicted distribution of herbivores in Iceland ... Boulanger-Lapointe, Ágústs dóttir, et.al (in review)

Species Distribution Models

- Using presence only data for SDM (specifically decision tree ensembles).

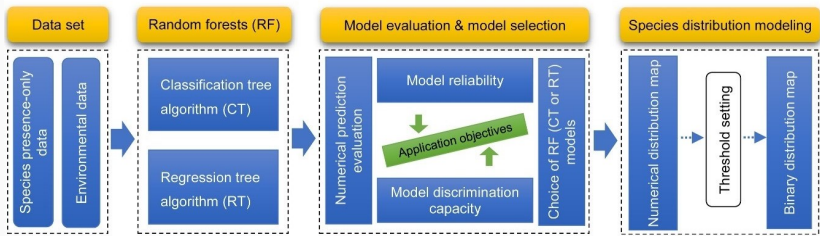


Figure 2: The use of classification and regression algorithms using the random forests method with presence-only data to model species distribution, Zhang, Huettmann, et.al

Species Distribution Models

- RandomForest and TreeNet(Boosted Trees) Models were fitted using Salford Predictive Modeler.



Salford Predictive Modeler®

- RandomForest
 - 500 trees.
 - Minimum of 2 samples per leaf.
 - Bootstrapped 3 predictors and 94,000 observations(WR).
- TreeNet
 - 500 trees.
 - Maximum of 6 nodes per tree.
 - Bootstrapped 3 predictors and 94,000 observations(WR).

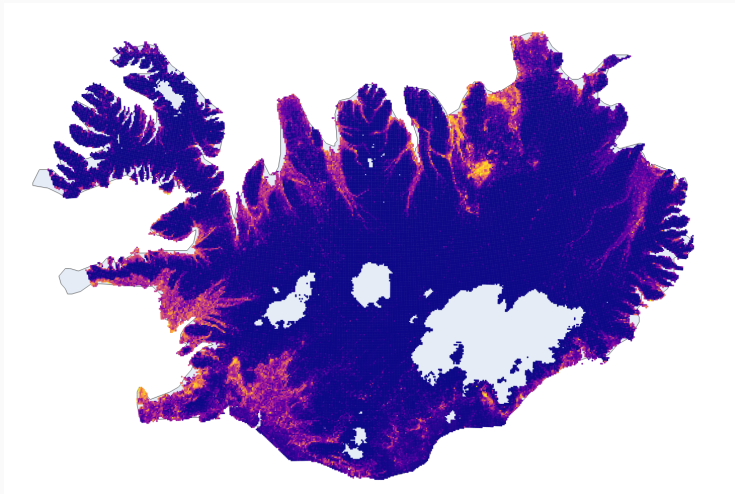


Figure 3: Random Forest Model

Results











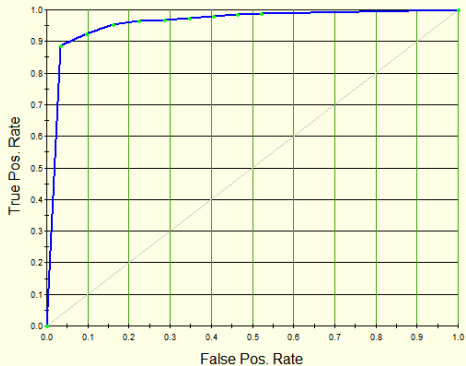
Variable	Score ▾	
DEM250	100.00	
JJA_TAVG25	73.58	
JJA_PPT_AV	64.04	
NDVIMAX250	48.34	
DIST_PASTU	46.75	
DISTANCE_W	13.00	
VEG250	8.27	
JJA_MEAN_W	7.62	
SLOPE250	5.69	
SOIL250	3.32	
REMOTENESS	0.00	

Figure 4: Random Forest Variable Importance

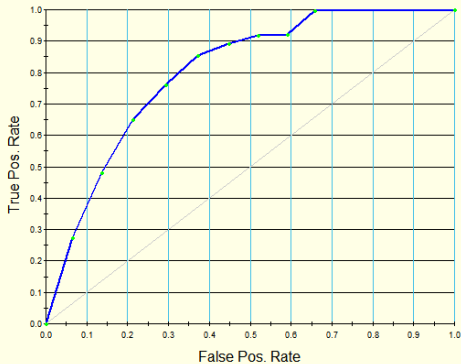
Results

- Accuracy of 91.98% on out of bag samples.



Results

- Accuracy of 72.91% on outside data with kriged predictors.



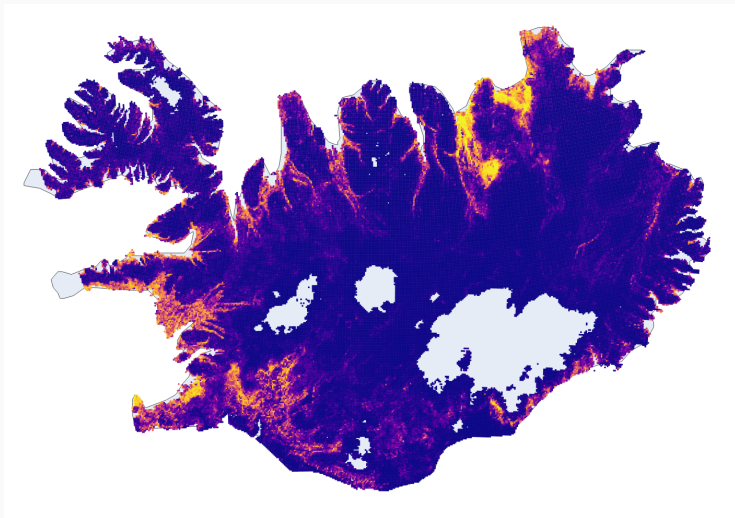


Figure 5: TreeNet(Boosted Tree) Model

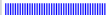










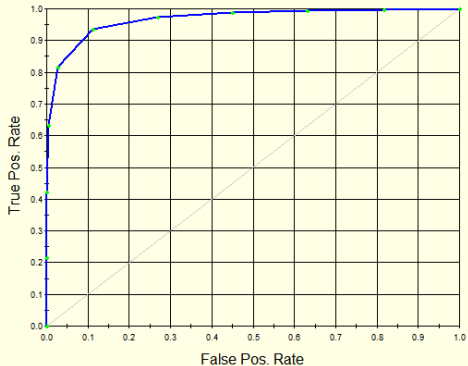
Variable	Score	
DEM250	100.00	
JJA_PPT_AV	56.12	
JJA_TAVG25	52.38	
SOIL250	51.98	
JJA_MEAN_W	35.95	
DIST_PASTU	34.99	
NDVIMAX250	33.55	
DISTANCE_W	30.91	
SLOPE250	30.89	
VEG250	19.47	
REMOTENESS	8.36	

Figure 6: TreeNet(Boosted Tree) Variable Importance

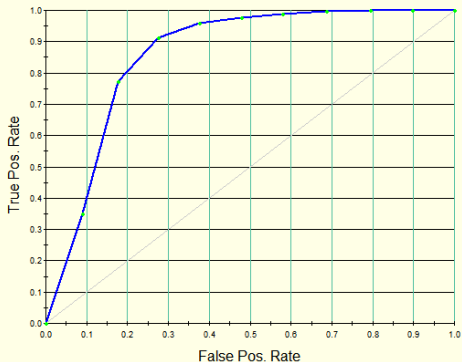
Results

- Accuracy of 91.77% on Cross-Validated samples.



Results

- Accuracy of 80.78% on outside data with kriged predictors.



Learnings

- In all models Elevation, Precipitation, and Temperature were the most significant predictors.
- Issues with model training, specifically bootstrapping and spatial autocorrelation,

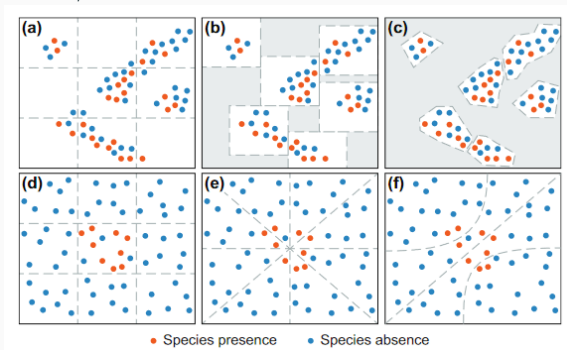


Figure 7: Cross-validation strategies for data with temporal, spatial, hierarchical, or phylogenetic structure... Roberts et.al