

A Habitat-Based Wind-Wildlife Risk Tool With Application to the Upper Great Plains Region



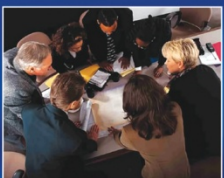
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October 18, 2011



Objectives

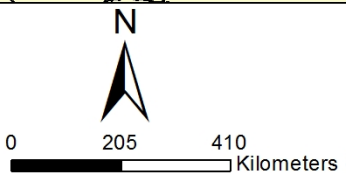
- Develop spatial collision models based biological and environmental variables
- Model output: maps of relative predicted collision mortality for each focal species
- Increase understanding of large-scale factors influencing collision risk





DOE Study Area

-  Badlands and Prairies
-  Central and Mixed Grass Prairie
-  Prairie Potholes
-  Shortgrass Prairie
-  Lakes
-  Boundaries



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Focal Species

- Grassland Songbird – Horned Lark
- Neotropical Songbird – Red-eyed Vireo
- Waterfowl – Mallard
- Shorebirds – American Avocet
- Raptors – Golden Eagle
- Whooping Crane
- Migratory Tree Bats
 - Hoary
 - Red
 - Silver-haired



Focal Species

- Grassland Songbird – Horned Lark
- Silver-haired Bat





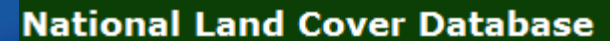
Wildlife Data

- Breeding: North American Breeding Bird Survey
 - 5221 counts over 20 years
- Winter: Christmas Bird Counts
 - 2547 counts over 20 years
- Migration: eBird Data - Quality Controlled
 - 351 counts over 20 years (HOLA)
 - Changes depending on migration timing



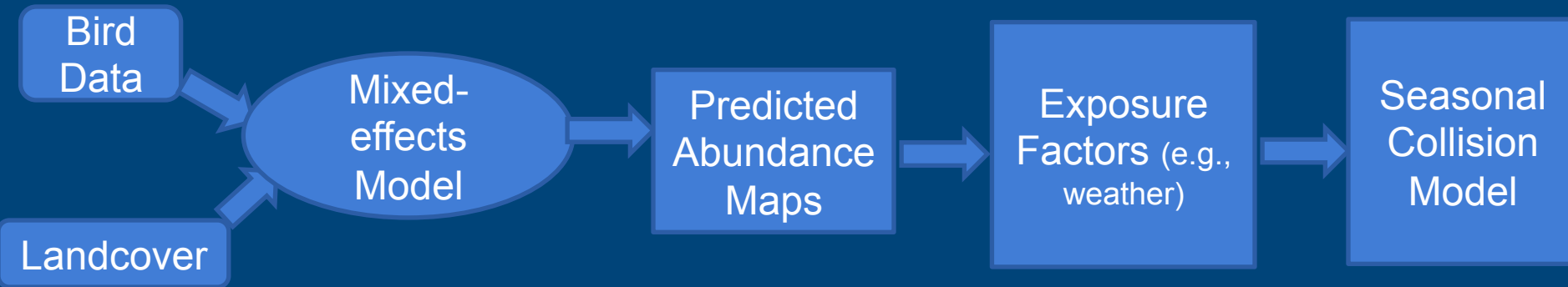
Environmental Data

- Weather
 - National Climate Data Center
- Topography
 - National Elevation Dataset
- Land Use
 - National Landcover Dataset 2001
- Forest Stand Age
 - Canopy Height and Biomass data
- Behavioral
 - Known seasonal behaviors from literature



General Approach - Birds

- For each species for each season



- For each species



Mixed-effects Model

- Hierarchical spatial modeling approach using a linear mixed model (LMER)
- Random effects for time, space, and observer
- Modeling bird abundance as function of land use at multiple scales
 - 1,000 ha
 - 10,000 ha
 - 50,000 ha
 - 100,000 ha



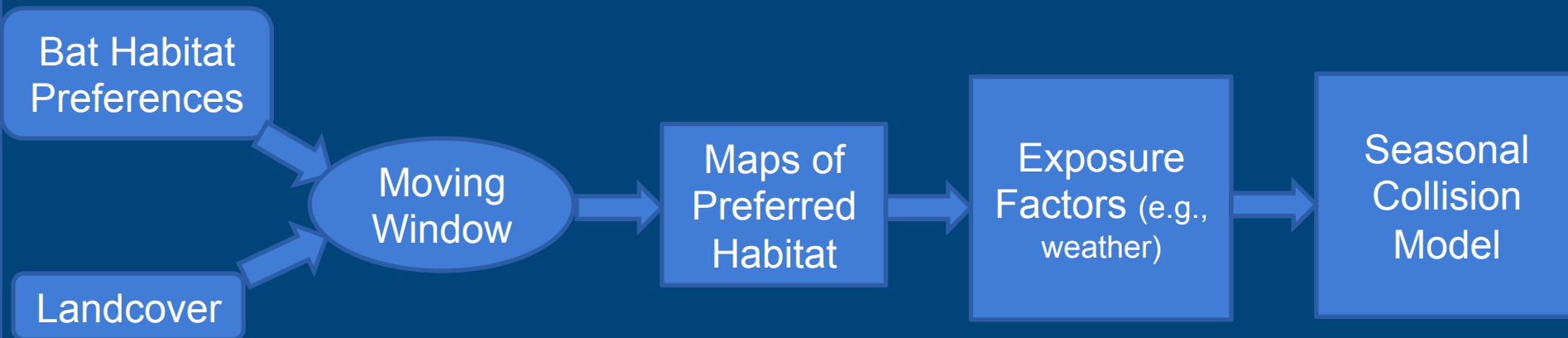
Bat Modeling

- Models are based on known habitat preferences
- Define habitat features that influence occurrence
 - Forest %
 - Forest Edge Density
 - Forest Stand Age
 - Open Water %
 - Distance to Water



General Approach - Bats

- For each species for each season



- For each species



Exposure Parameters

- Behavior

- Seasonal models weighted based on occurrence of risky behavior

- Weather

- Birds

- Average daylight hours with <0.5 mile visibility

- Bats

- Average night hours with <7 m/s wind speed
- Average night hours with no rain
- Average night hours with > 50 degree temps



Model Evaluation

- Bird Abundance models
 - Compare abundance predictions with observed results using ~20% of data withheld from model construction (birds)



Model Evaluation

- Compare predicted mortality with mortality reported in publically available studies
- Sensitivity Analysis
 - Importance of abundance and habitat vs exposure is not well-characterized
 - Modeled 6 different scenarios with different weights for abundance/habitat and exposure
 - Evaluated prediction of each scenario



Sensitivity Analysis



★ Wind Resource Areas

Water Bodies

Boundaries

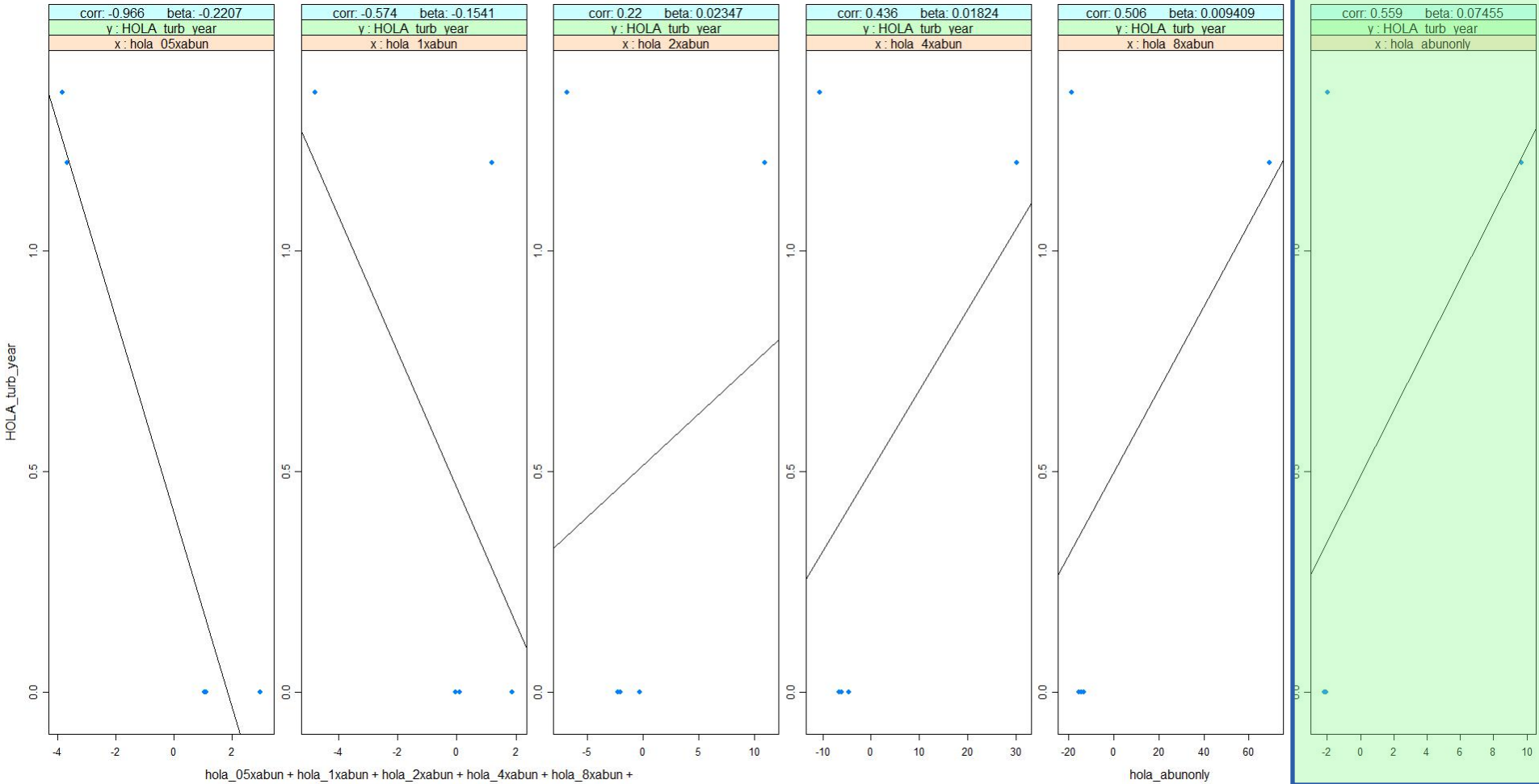


0 205 410
Kilometers

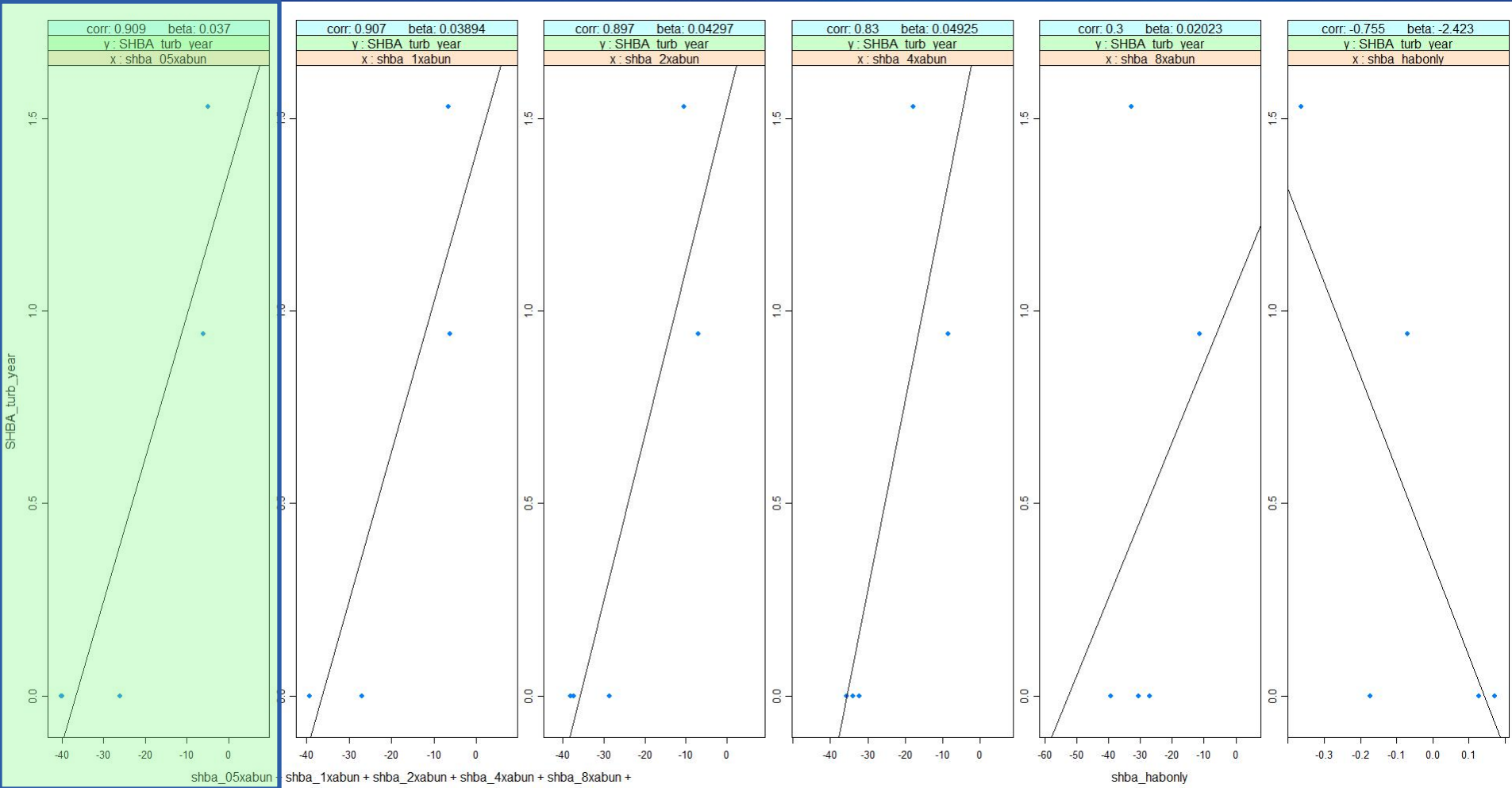
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HOLA Sensitivity Analysis



SHBA Sensitivity Analysis



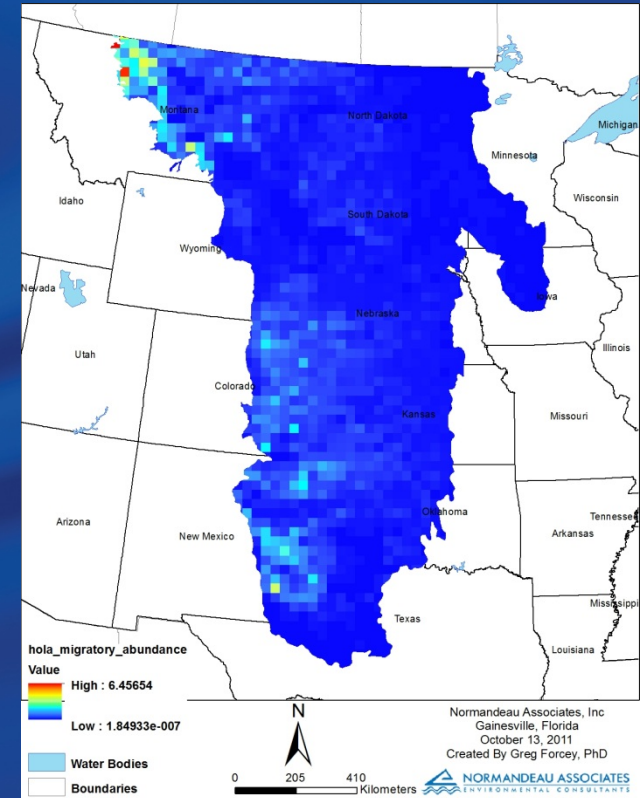
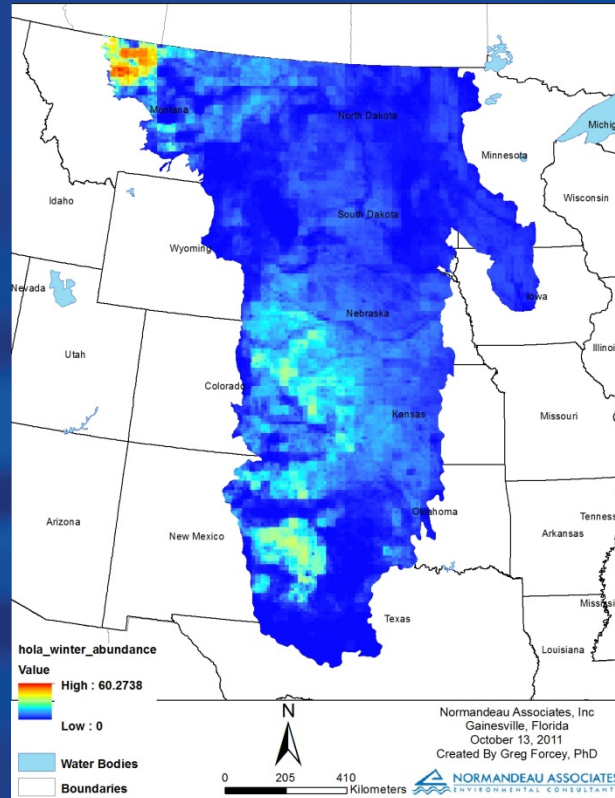
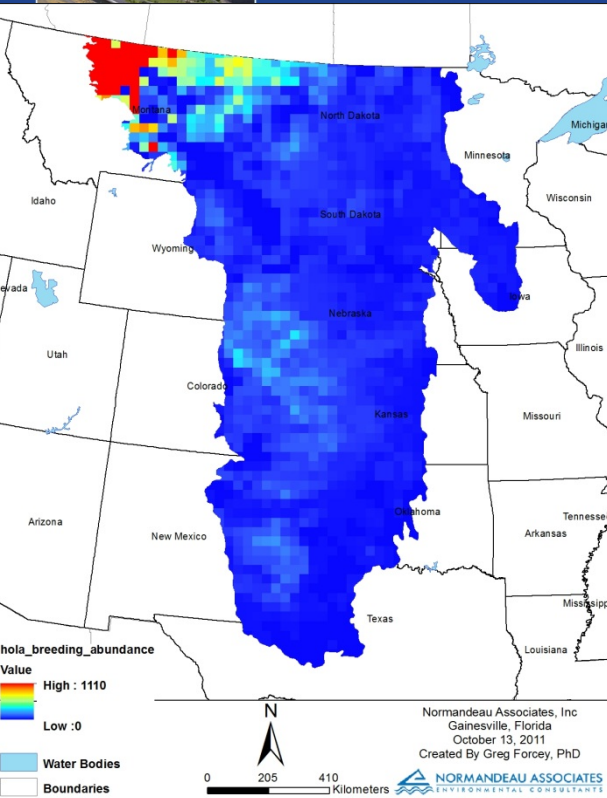
HOLA Abundance Predictions



Breeding

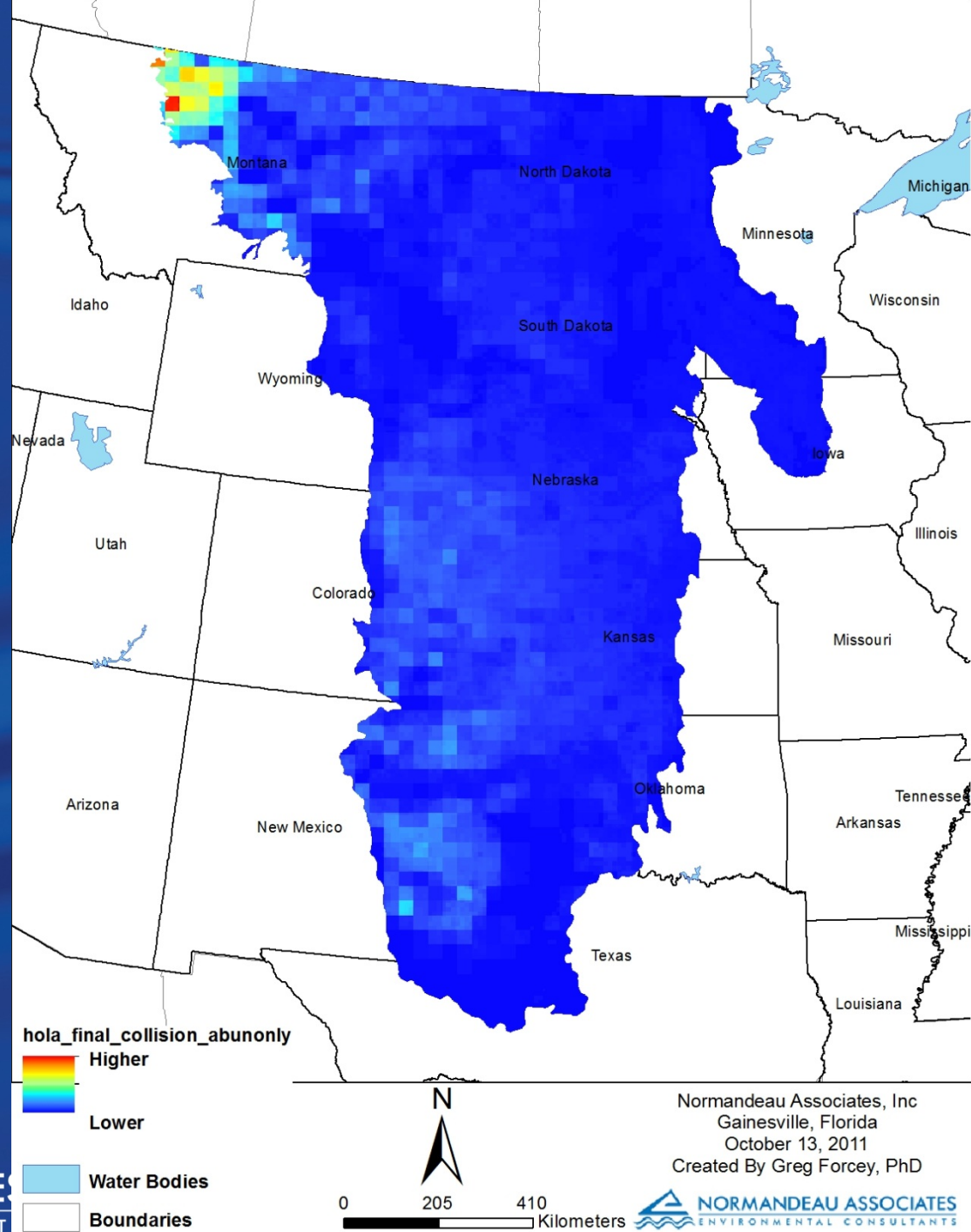
Winter

Migration

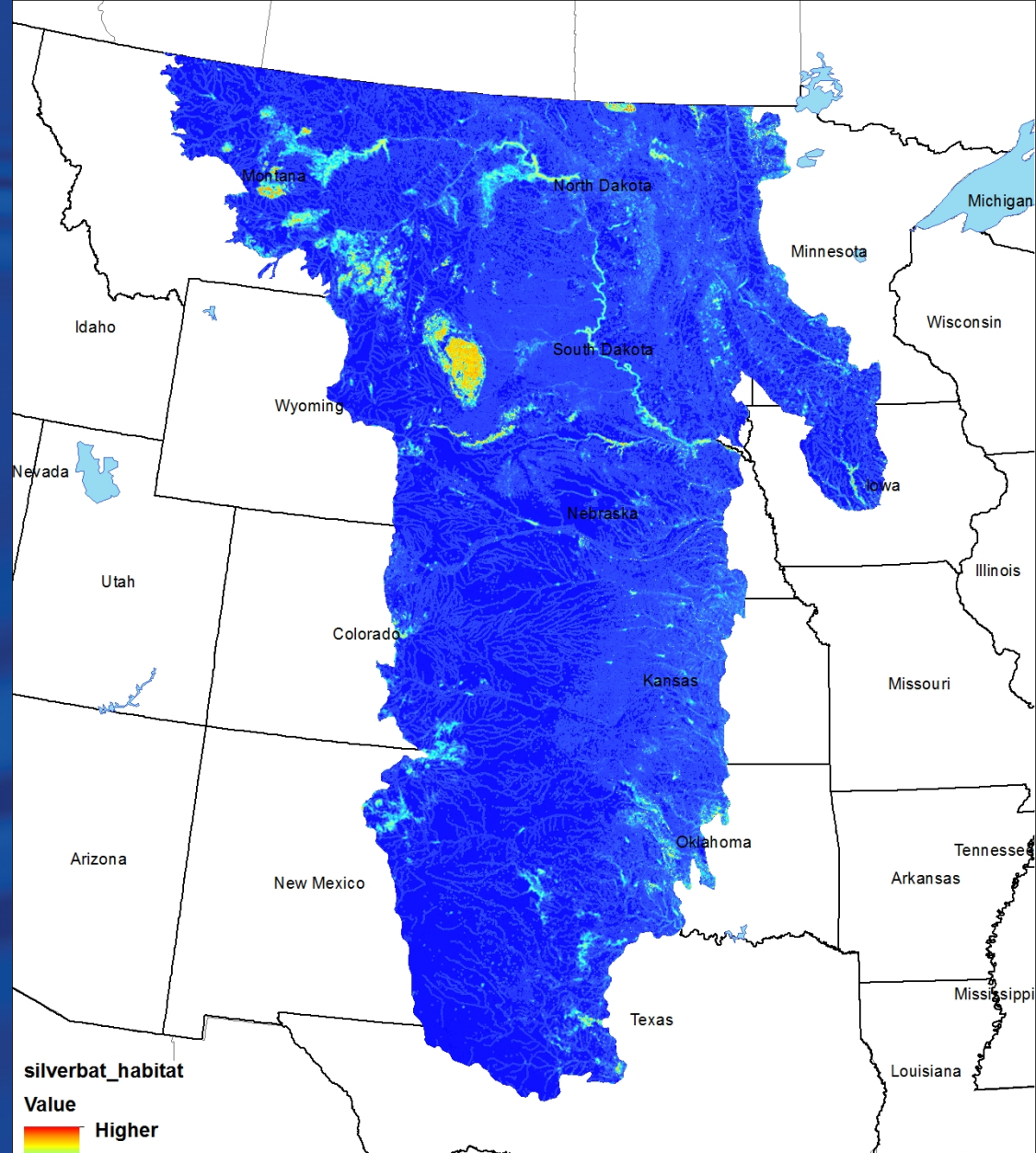


HOLA Collision Prediction

- Collision Risk predictions are relative
- Smoothing is due to high predictions in the NW

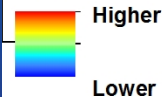


SHBA Habitat Suitability



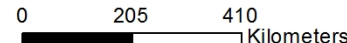
silverbat_habitat

Value



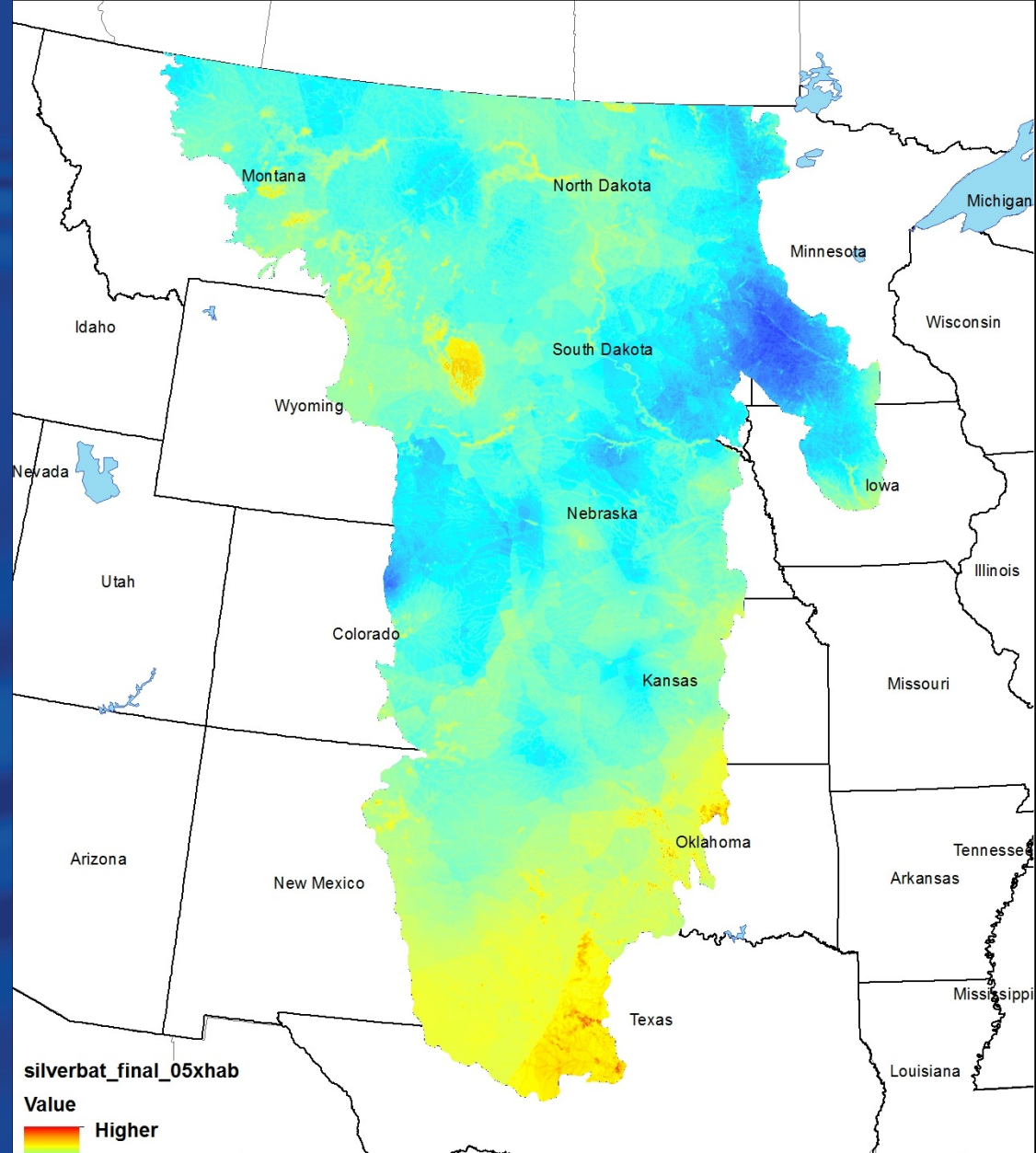
Water Bodies

Boundaries



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SHBA Collision Risk



silverbat_final_05xhab
Value
Higher
Lower
Water Bodies
Boundaries

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Conclusions

- Influence of abundance/habitat vs weather varies among species
- HOLA
 - Risk driven mostly by abundance
 - Risk higher in western portion of area
- SHBA
 - Weather variables having more effect on mortality
 - Risk is higher around certain habitat features



Limitations

- Applicability limited to large-scales
- Field studies are needed to validate models at small scales
- Sensitivity analyses could benefit from larger sample size



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