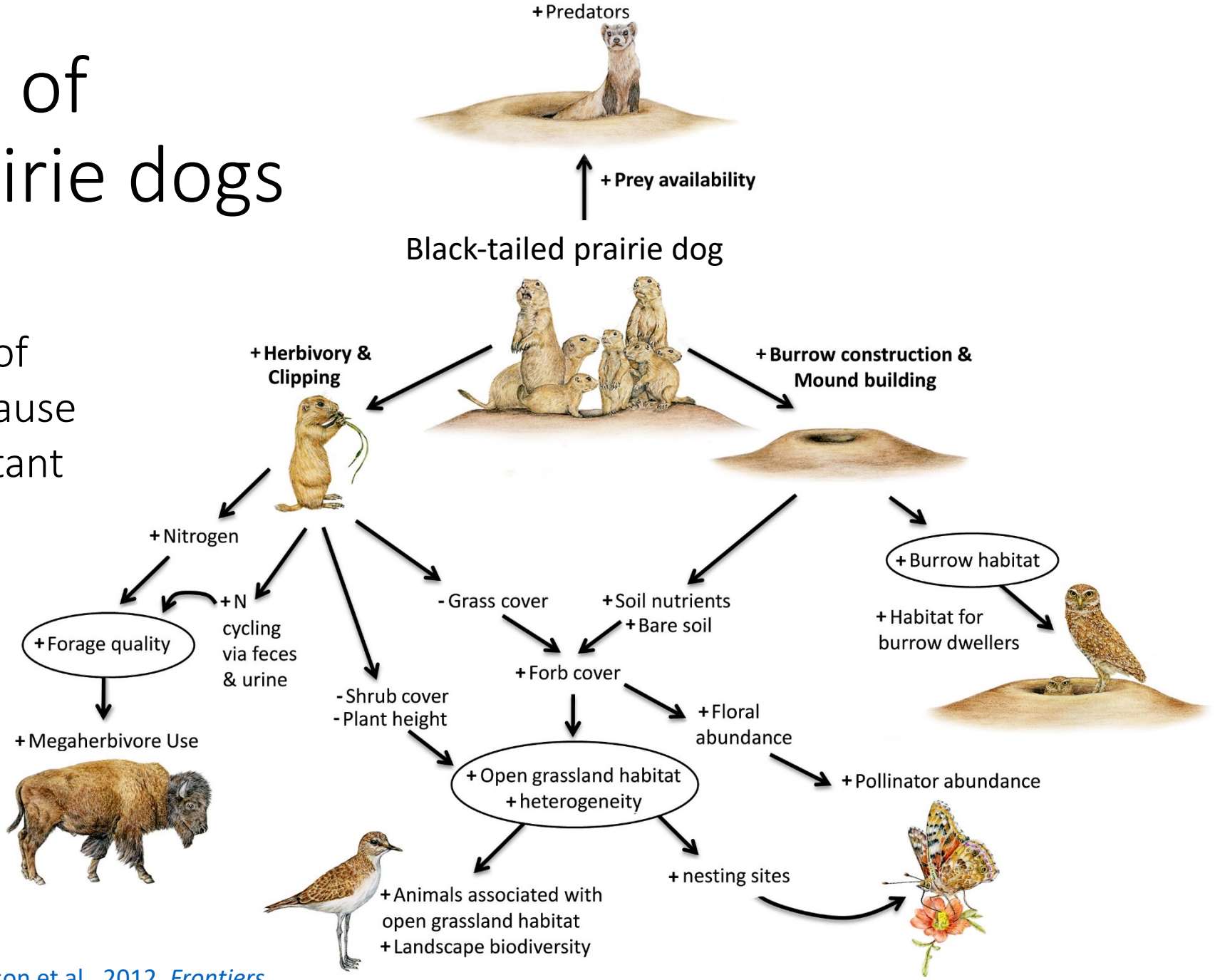
Homes on the Range Webinar:

Identifying potential landscapes for conservation across North America's central grasslands: Integrating keystone species, land use patterns, and climate change

Ana Davidson, Colorado Natural Heritage Program (CNHP) &
Dept. of Fish, Wildlife and Conservation Biology, Colorado State Univ (CSU)
David Augustine, USDA-Agricultural Research Service
Michael Menefee, CNHP, CSU
Michelle Fink, CNHP, CSU
Michael Houts, Kansas Biological Survey
Fernanda Thiesen Brum, Universidade Federal do Paraná – Brazil
Matt Williamson, Boise State University
Lindsey Sterling-Krank, Prairie Dog Coalition, Humane Society of the US
Bill Van Pelt, Western Association of Fish & Wildlife Agencies (WAFWA)

Ecological roles of black-tailed prairie dogs

Restoring and maintaining prairie dogs lies at the core of grassland conservation, because of the fundamentally important keystone role they play



Davidson et al., 2012, *Frontiers*

Create unique islands of grassland habitat

Black-tailed prairie dog colonies

Davidson et al., 2012, *Frontiers*

USFWS black-footed ferret recovery plan specifically states, "We believe the single, most feasible action that would benefit black-footed ferret recovery is to improve prairie dog conservation. If efforts were undertaken to more proactively manage existing prairie dog habitat for ferret recovery, all other threats to the species would be substantially less difficult to address."

Objective: Identify potential landscapes for grassland conservation

1) Generate model scenarios and map products

2) Collaborative process with wildlife & land managers

3) Follow this modelling effort up with on-the-ground implementation

Methods for Identifying potential landscapes for grassland conservation

1) Generate BTPD habitat suitability model – prairie dog ecosystem focus

2) Incorporating future climate change predictions into BTPD habitat suitability model

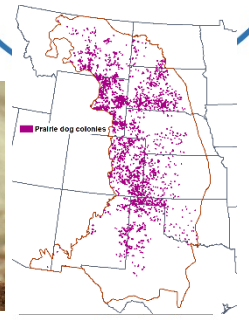
3) Identifying current & future priority areas within predicted suitable habitat

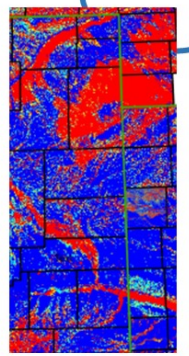
Methods (Part I):

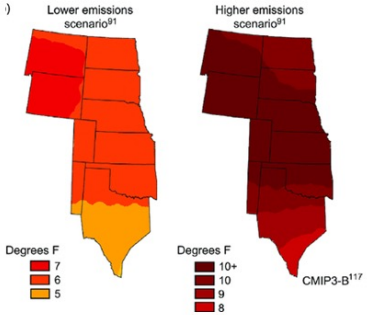
Identify geographic range boundary & obtain BTPD occurrence data
Use WEST range-wide occurrence data and define boundary from this data and historical records

Create BTPD habitat suitability model
Based on WEST BTPD occurrence data, current climate, soils, topography, land cover

Project habitat suitability for BTPD under future climate
Project climate to 2100 from downscaled Global Climate Models (Multivariate Adaptive Constructed Analogs (MACA)



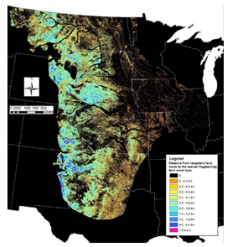




Methods (Part II):

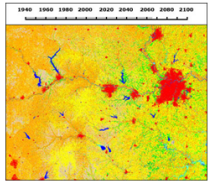
Habitat Suitability Model

Great Plains Fragmentation



Conservation Prioritization Model (Zonation)

Projected land use change



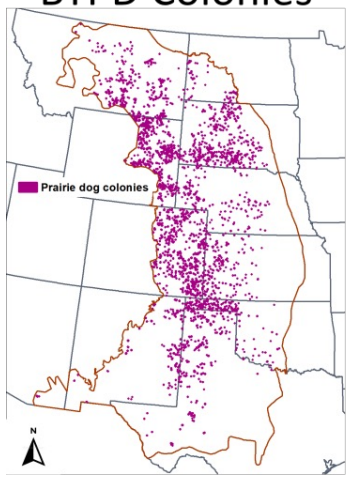
Identify potential landscapes for grassland conservation both now and in the future
Based on BTPD habitat suitability, existing distribution of BTPDs, projected climate and land use change, patch size, connectivity, threats, and social landscape

Scenario 1 **Scenario 2** **Scenario 3** **Scenario x**

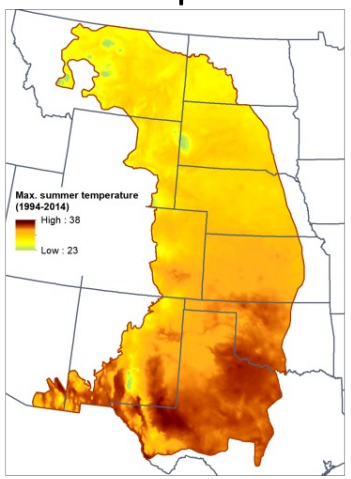
Methods (Part I): Habitat Suitability Model (HSM)

Variable	Spatial data layer for Habitat Suitability Model
BTPD colony occurrences	Prairie dog occurrences from WEST survey[10]
Land Cover	USGS National Land Cover Database 2016
Soils	POLARIS 30-m resolution database Metrics: bulk density to 100cm, %Sand to 100cm, %Clay to 100cm, % organic matter to 100cm, pH to 100cm
Slope & elevation	National Elevation Dataset Metrics: Topographic Wetness Index, Topographic Ruggedness Index, slope, aspect
Climate – current	Current climate (1994-2014), using GridMet Metrics: Mean annual precipitation (mm), winter + spring & summer + fall precipitation, max summer temperature, potential evapotranspiration, growing degree days

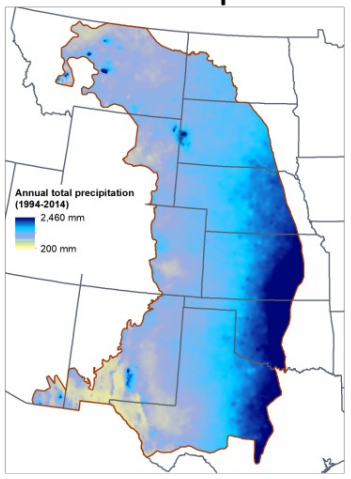
BTPD Colonies



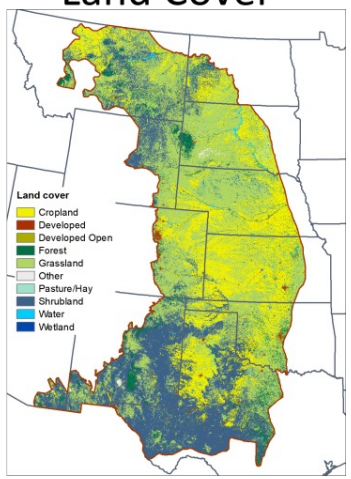
Max Temperature



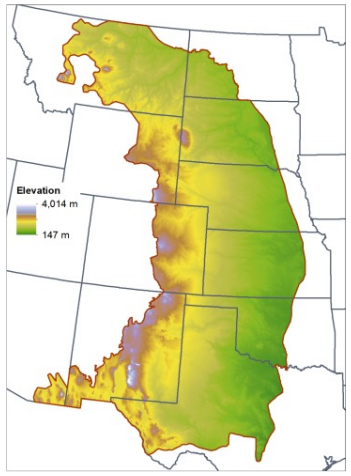
Annual Precipitation



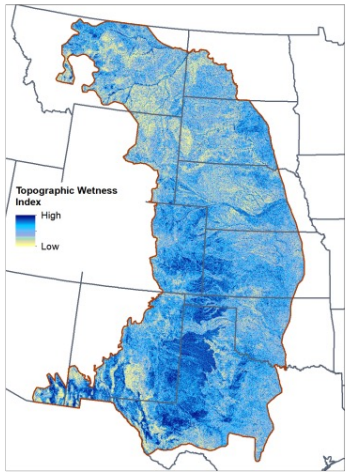
Land Cover



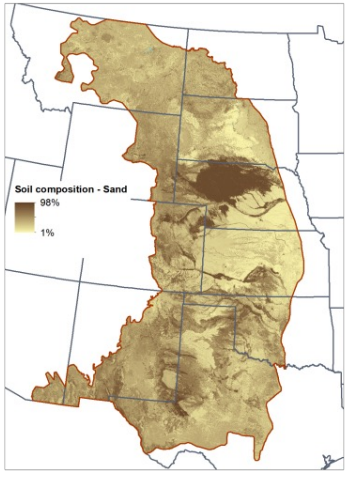
Elevation



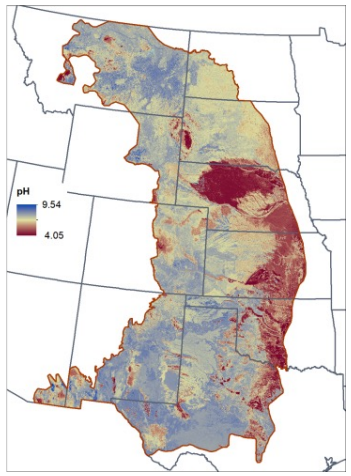
Topographic Wetness Index



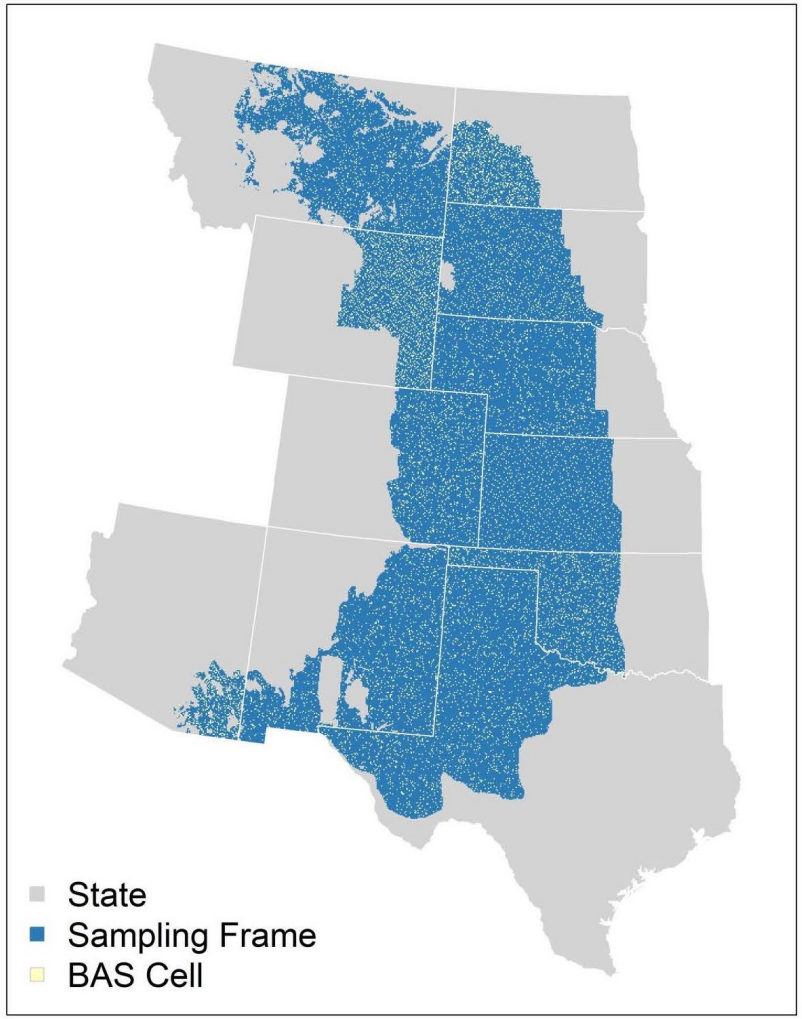
Percent Sand

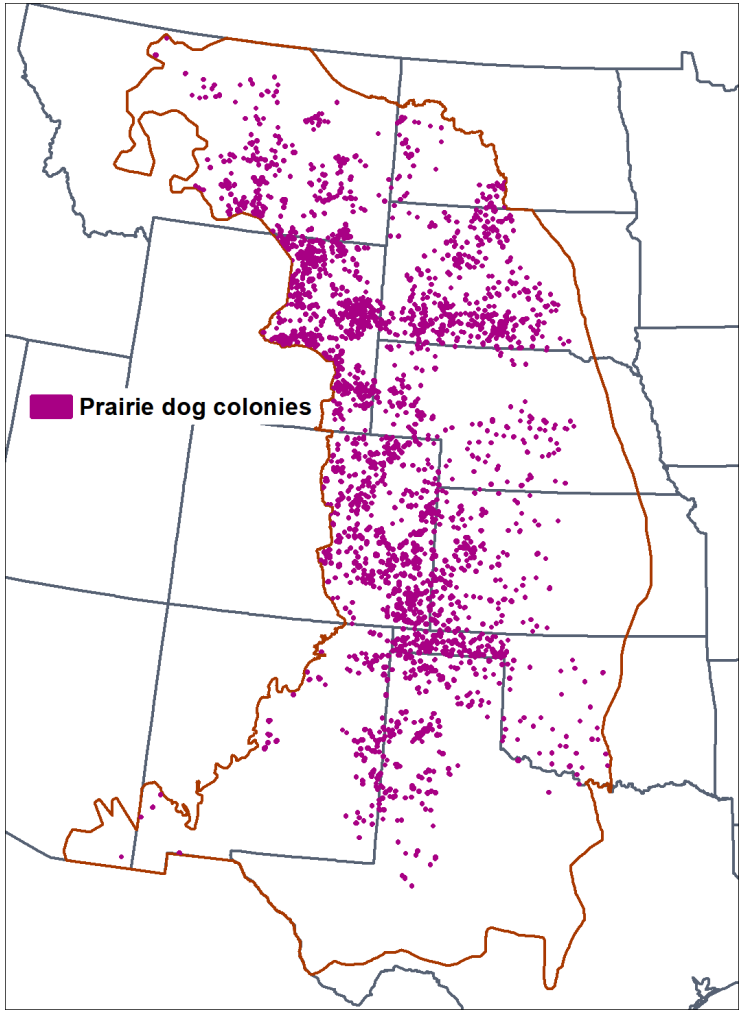


pH



Methods (Part I): Prairie dog colony occurrences





WEST data, from 2014

Methods (Part I): Habitat Suitability Modelling (HSM)

1) Create Habitat Suitability Model (also called Species Distribution Model) using different modelling methods
   a) Generalized Linear Mixed-Model (GLMM; traditional logistic regression model)
   b) Boosted Regression Trees (BRT; machine learning method)
   c) Random Forest (RF; machine learning method)

2) Create an ensemble model (the ensemble HSM combines the outputs of the GLM, BRT, and RF HSMs; each HSM using a different modelling algorithm)

Results (Part I): Ensemble Habitat Suitability Model

Performance metrics:

Model	AUC	TSS	kappa	PCC	Sensitivity	Specificity	Error rate
Ensemble	0.96	0.75	0.75	0.87	0.95	0.80	0.13

True Skill Statistic
TSS = TPR + TNR − 1

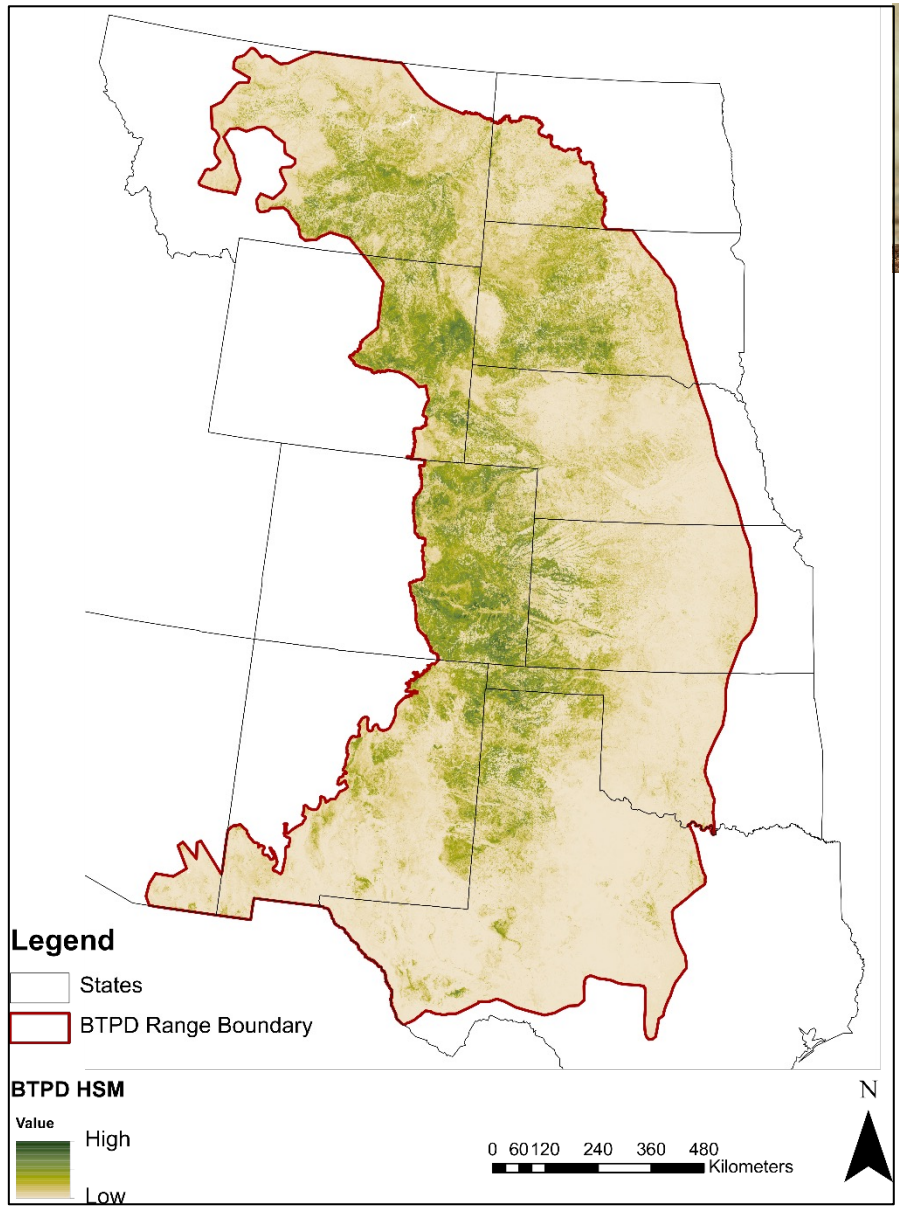
Percent correctly classified

ability to correctly identify **prairie dog habitat** (true positive rate)

ability correctly identify **non-prairie dog habitat** (true negative rate)

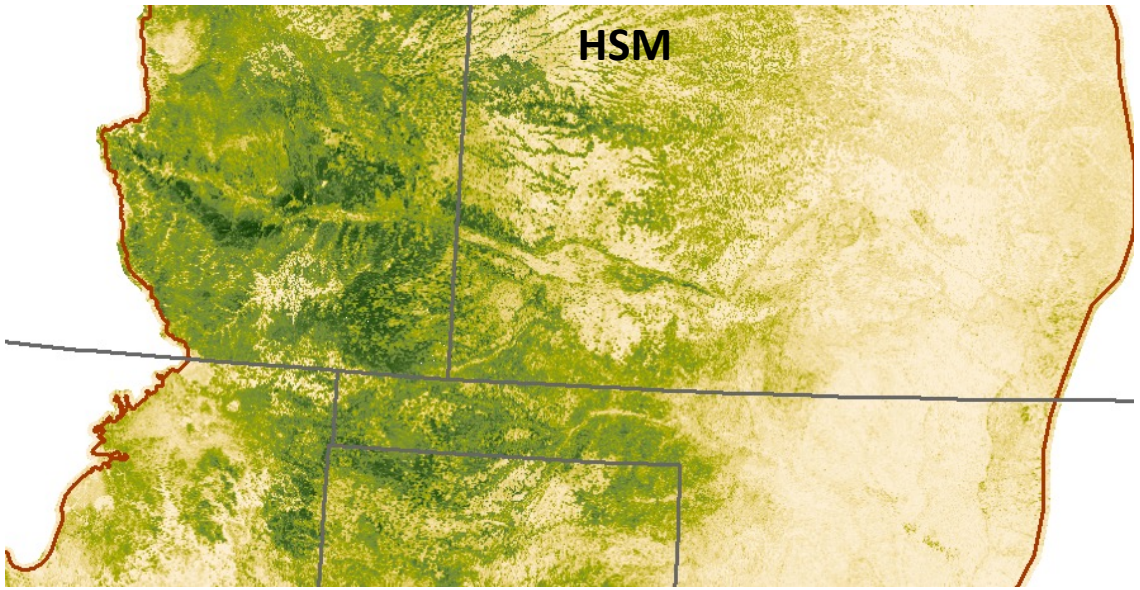
Results (Part I): Ensemble Habitat Suitability Model

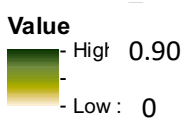
HSM under **current climate**

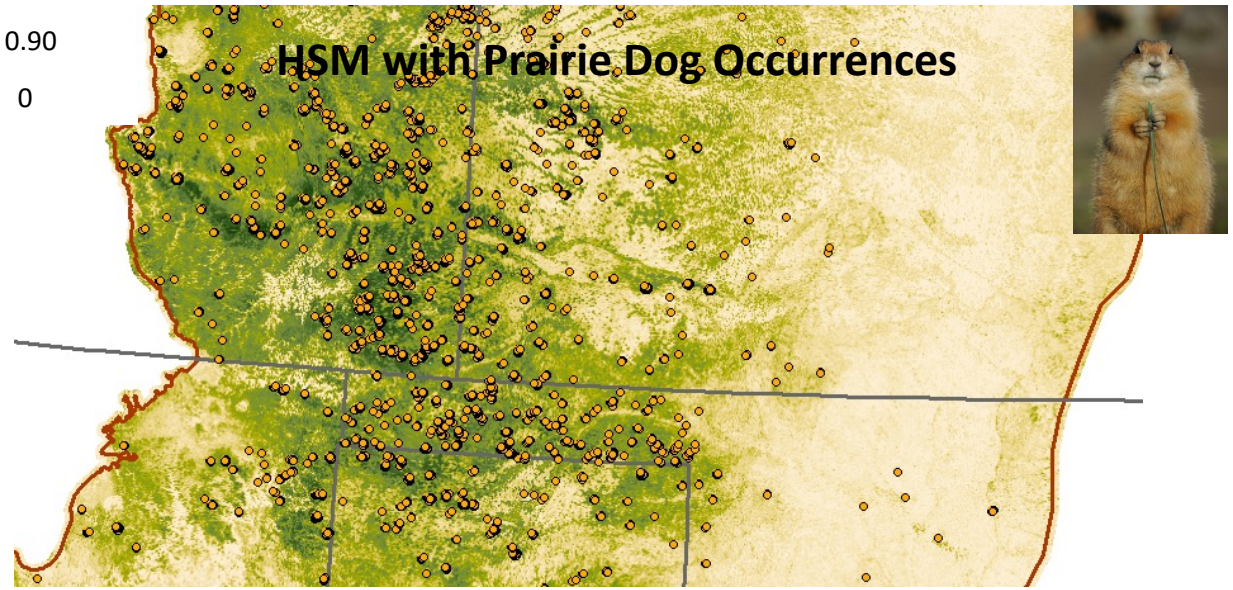


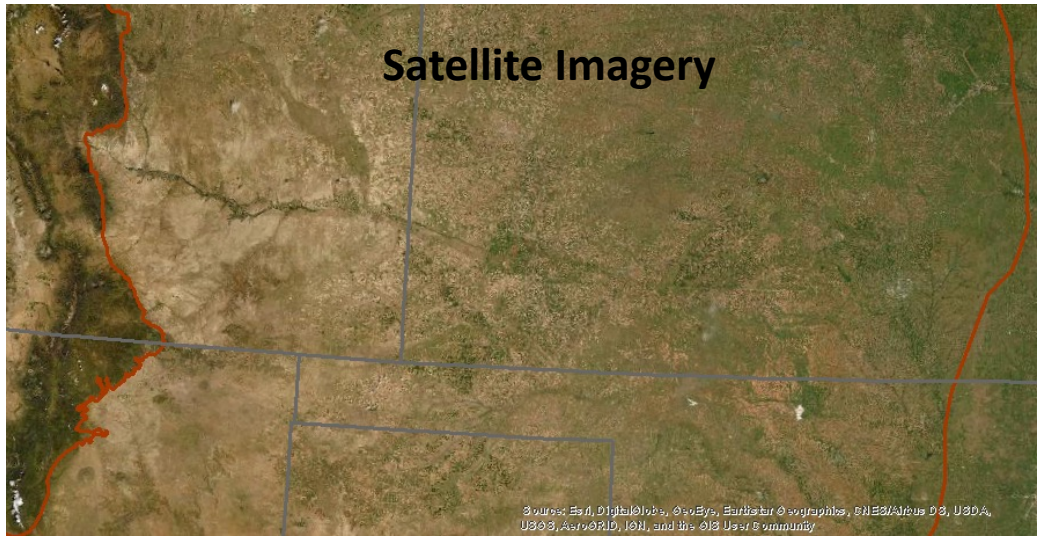
Michelle Fink,
Landscape Ecologist, Colorado Natural Heritage Program, CSU

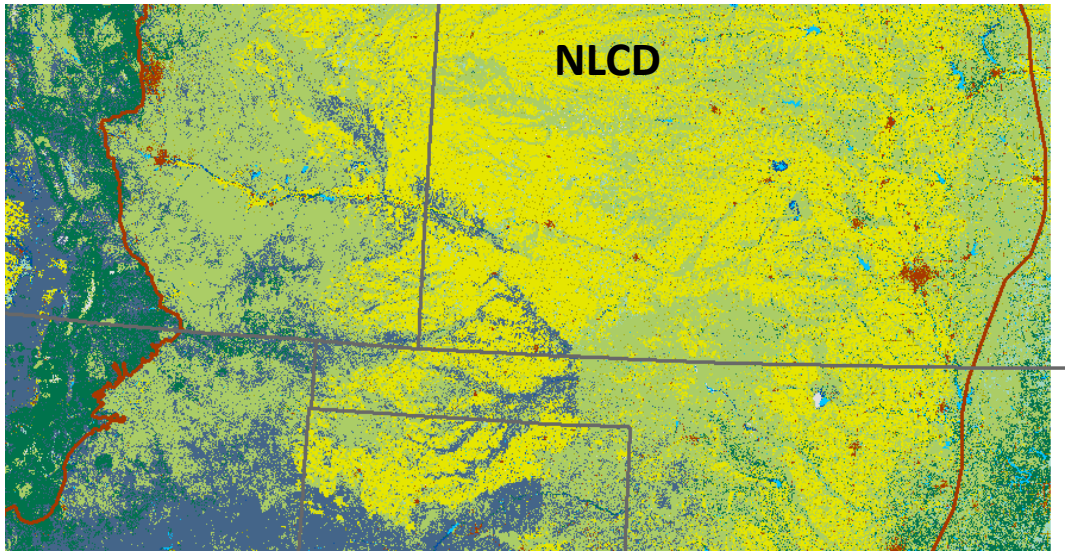
Results (Part I): BTPD Habitat Suitability Model



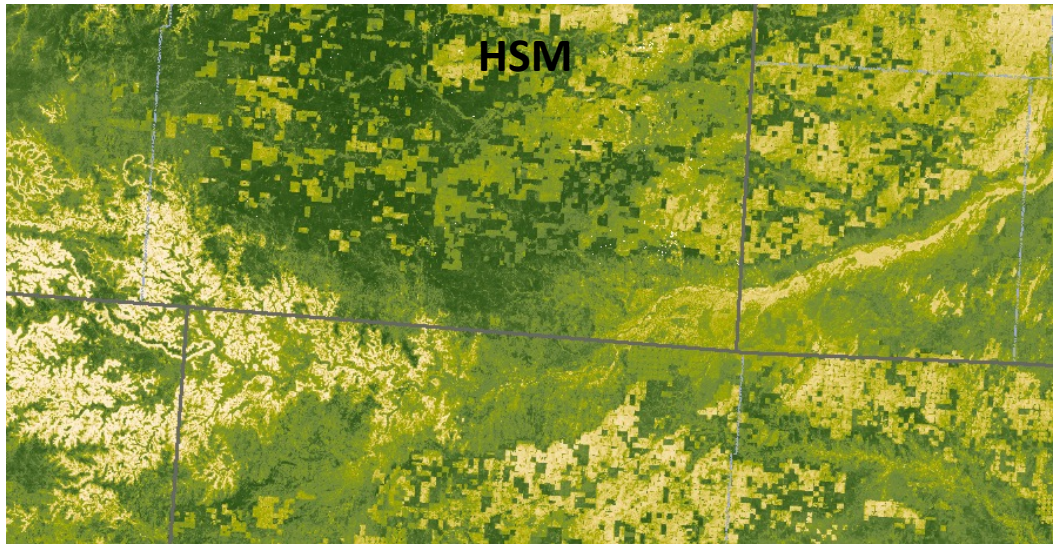


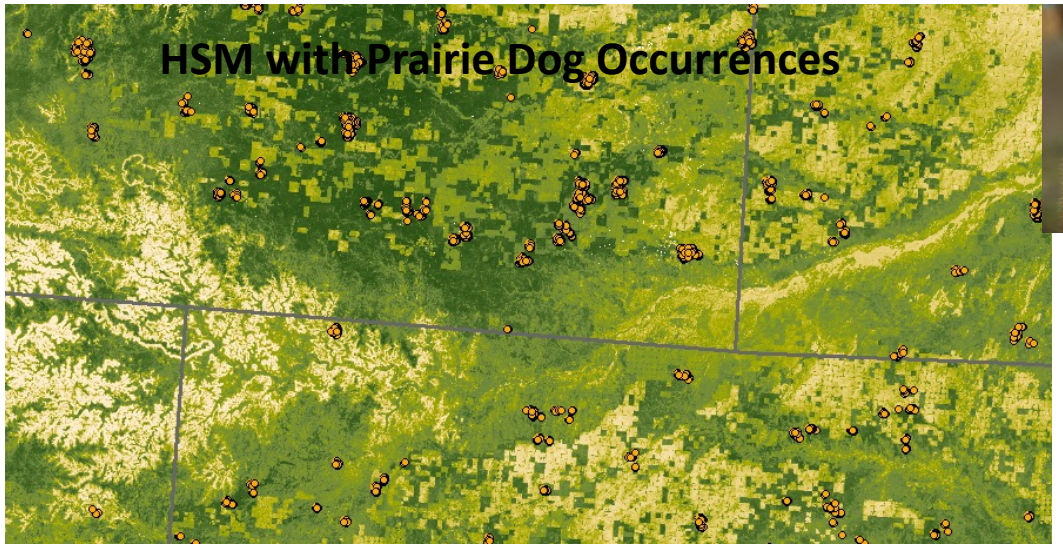


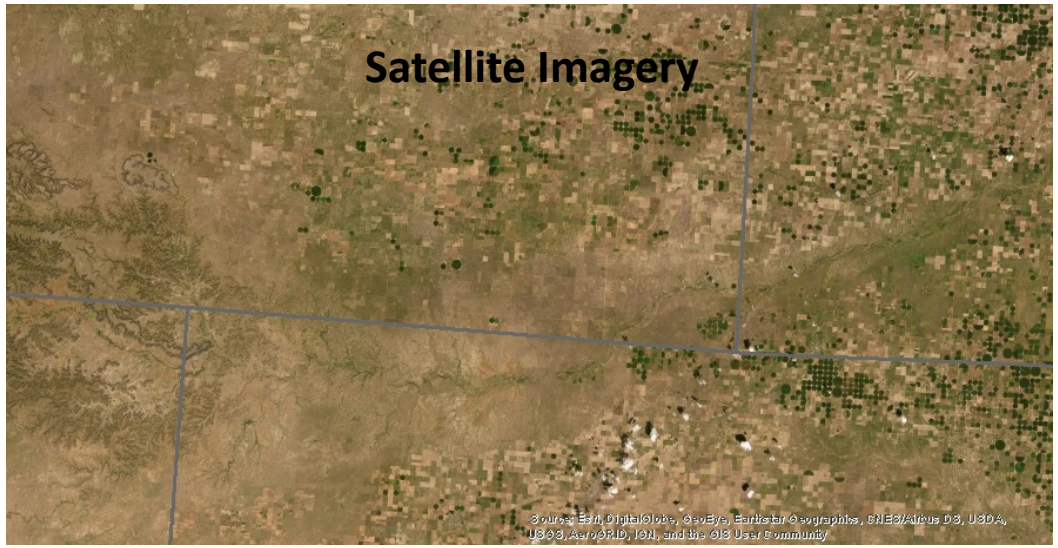


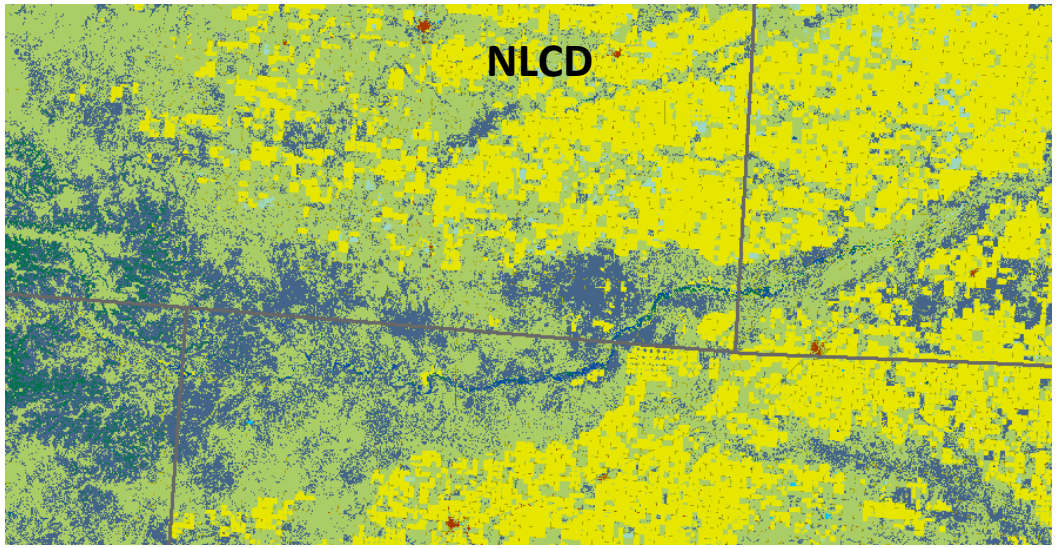


Results (Part I): BTPD Habitat Suitability Model



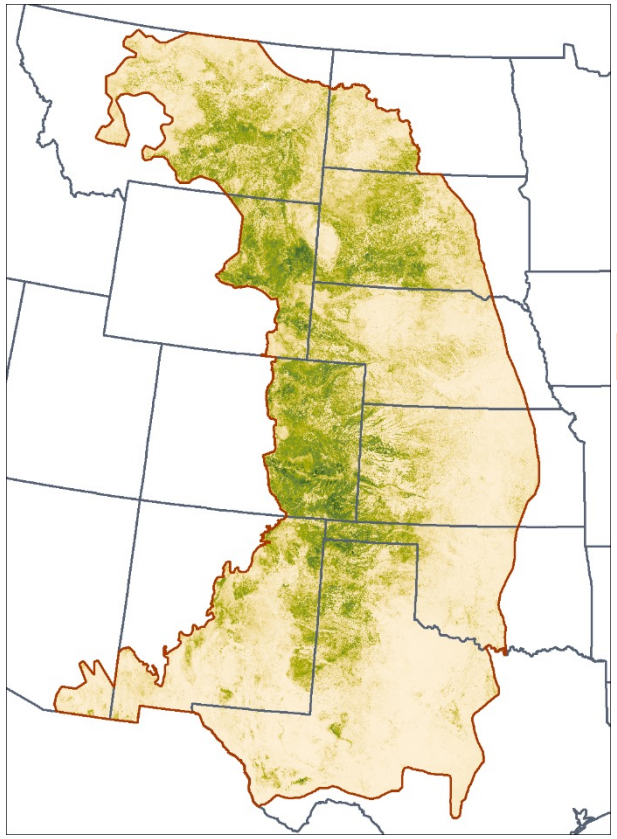




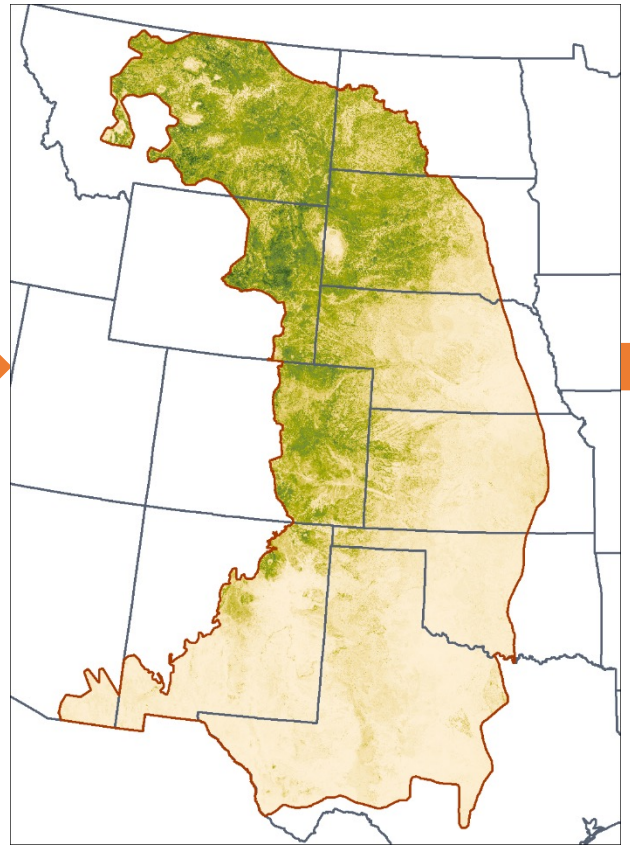


Results (Part I): BTPD Habitat Suitability Model under current & future climate (2100):

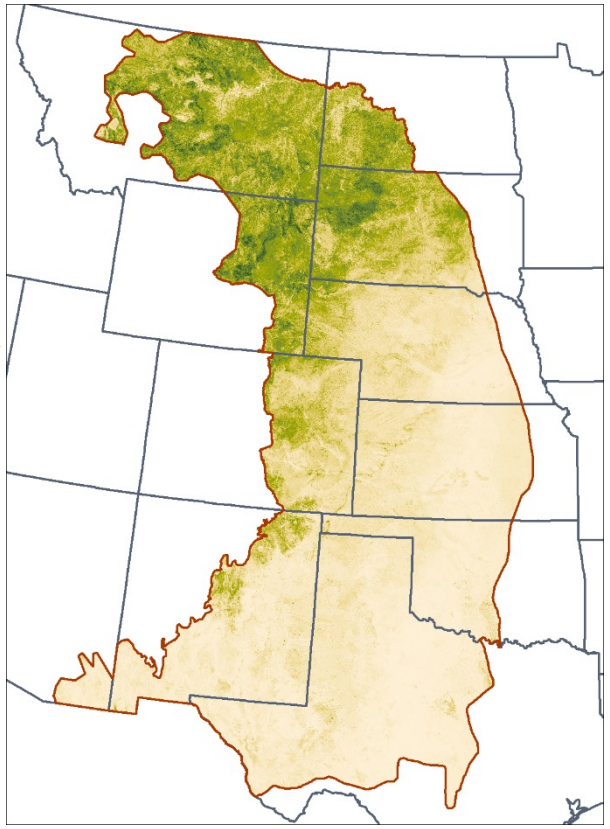
SDM under **Current Climate**



SDM under **Future Climate (warm & wet scenario)**



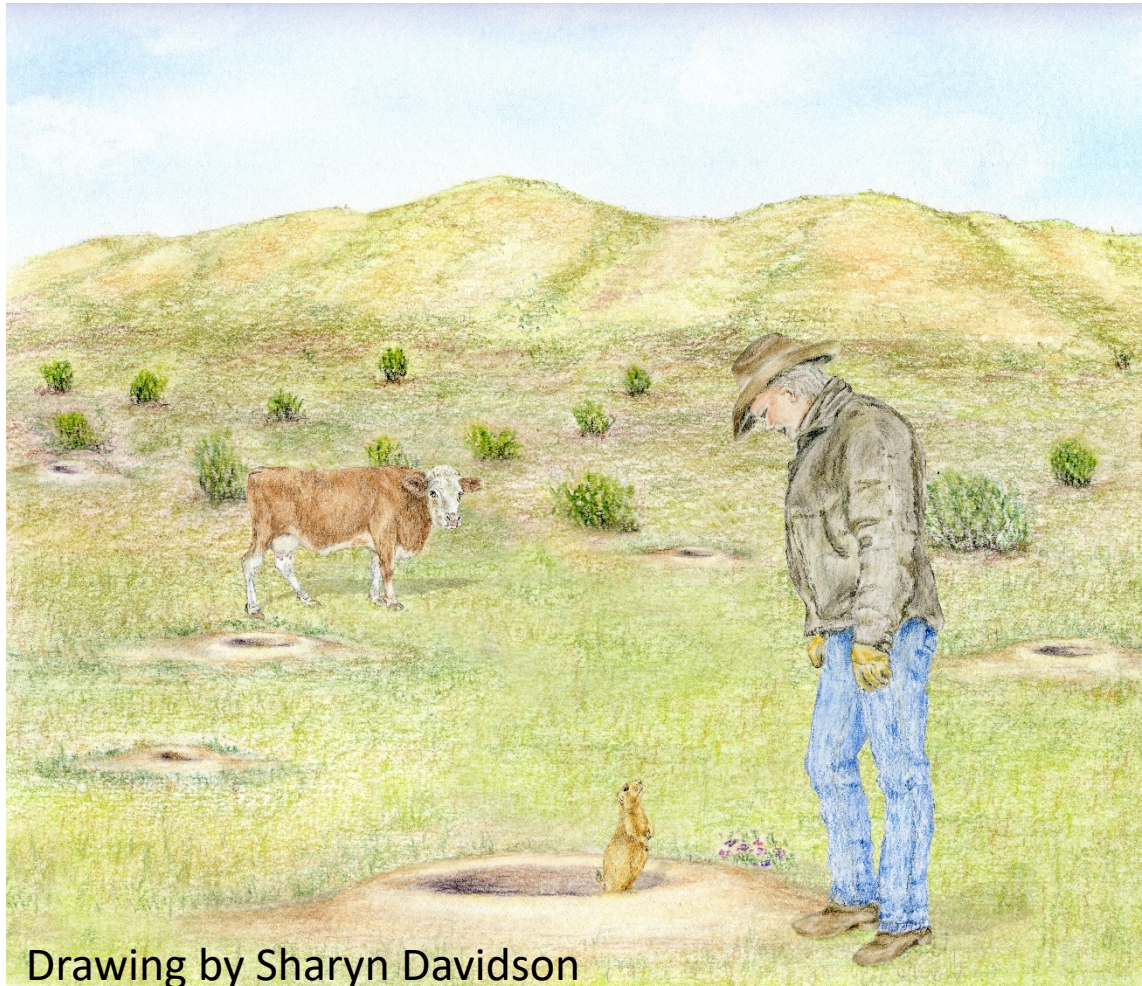
SDM under **Future Climate (hot & dry scenario)**



Imtiaz Rangwala, Climate Science Lead, North Central Climate Adaptation Science Center, USGS

Methods (Part II): Identifying current & future landscapes for grassland conservation, within predicted suitable habitat

Goal: *Not only assess the suitability of the habitat for the prairie dog ecosystem, but also the social and political landscape, threats (such as development), habitat connectivity, and general ecological landscape (e.g., percent cover of grass)*

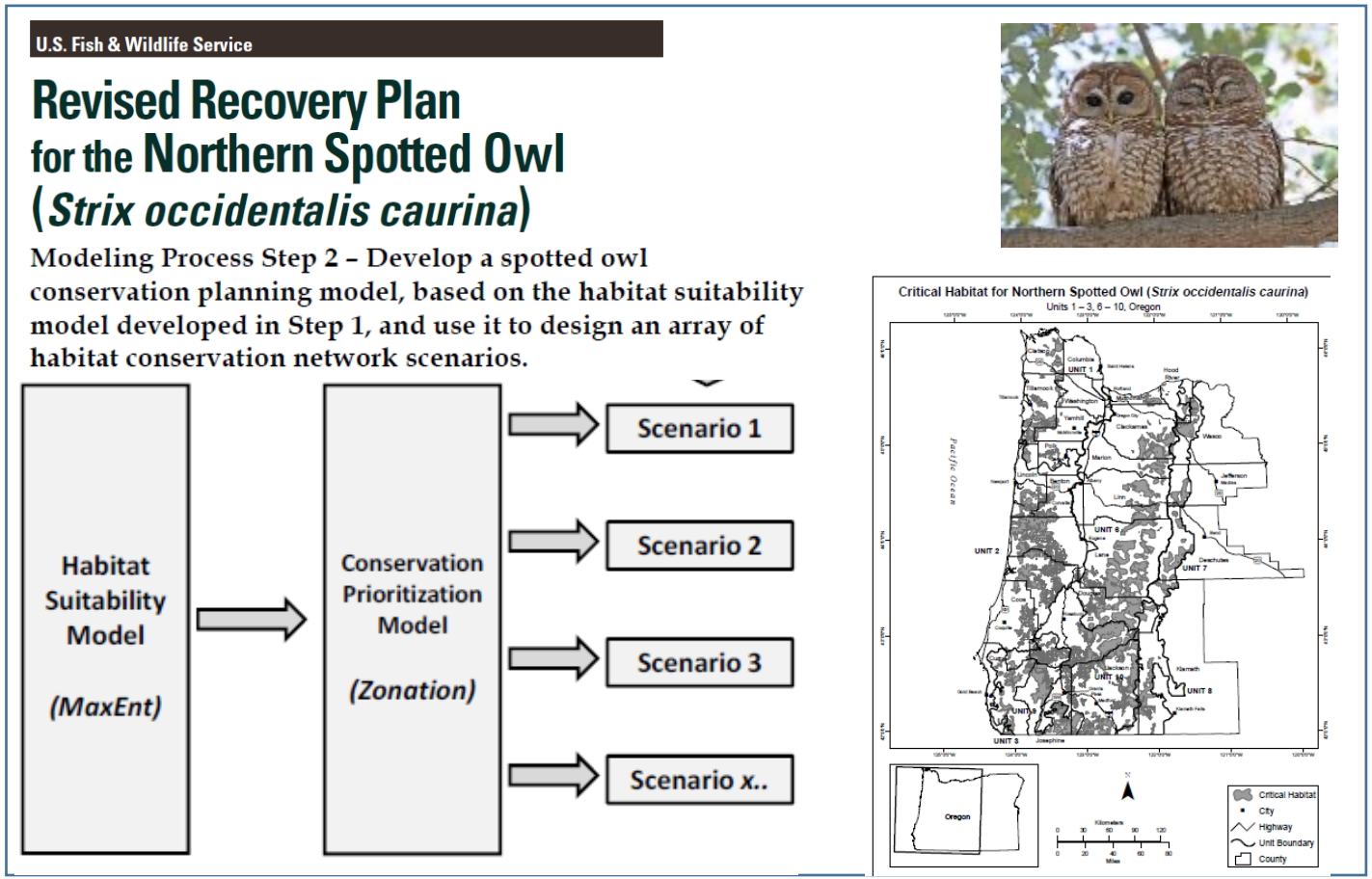


Drawing by Sharyn Davidson

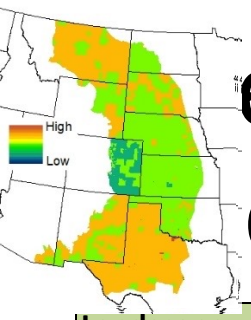
Methods (Part II): Identifying current & future landscapes for grassland conservation, within predicted suitable habitat

Using Conservation planning tool (Zonation) to identify multiple scenarios based on varying assumptions

Zonation produces a hierarchical prioritization of the landscape based on the conservation value or "habitat value" of cells

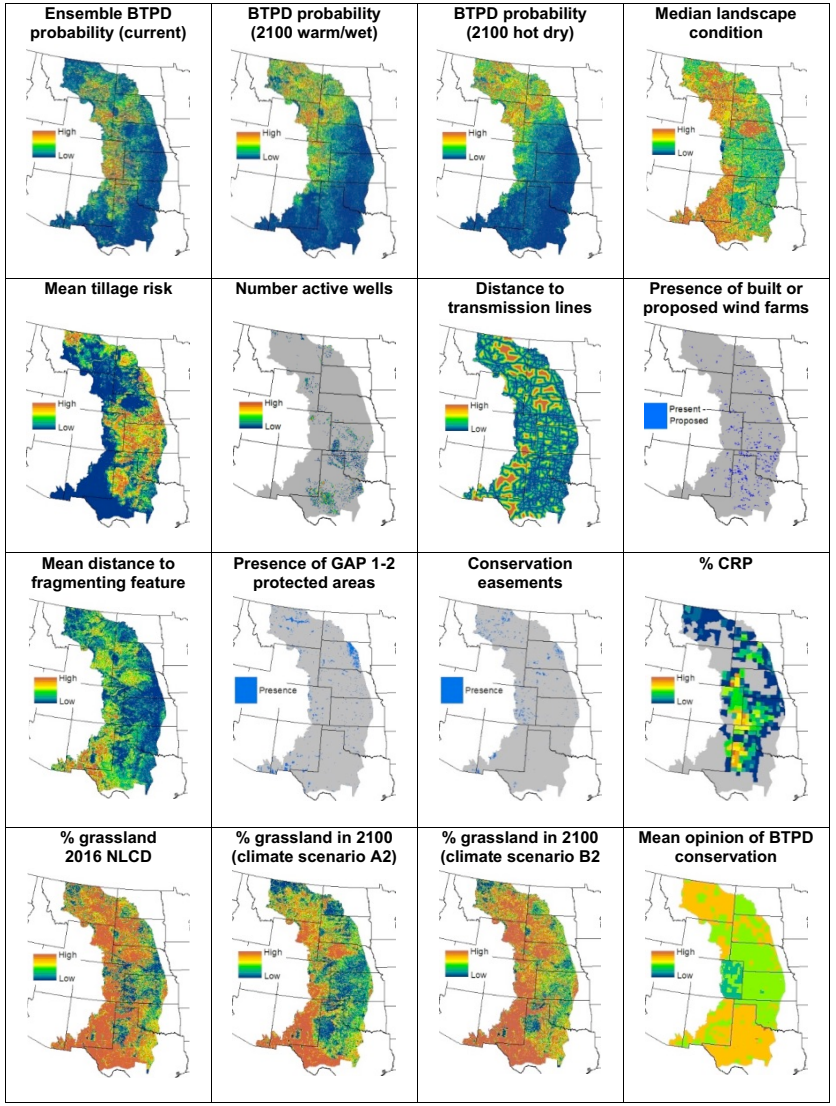


Our approach is similar to that used to identify scenario priority areas and inform the recovery plan for northern spotted owls



ethods (Part II): Incorporating landscape & cial variables to determine conservation

Landscape variables	Source dataset
Climate change	BTPD SDM under future climate change (2100) (Fink et al.)
Landuse change	USGS (projected 2100)
Landscape fragmentation	Augustine et al. (2019)
Private Lands Conservation	Turner+SPLT+APR property boundaries
BTPD occurences	WEST Data
Protected Area	PAD-US
% CRP	County level CRP
% Grass/shrub	2016 NLCD (52, 71, 81)
% Emergent wetland	2016 NLCD (95)
Percent tree cover	NLCD trees + NLCD % tree cover + PLJV cedar/mesquite
Tillage risk	Olimb tillage risk
Oil/gas wells (well count)	Welldatabase.com
Oil/gas wells (well density)	Welldatabase.com
Wind power potential	NREL wind speed at 100 meters
Distance to Transmission lines	DHS transmission lines
Wind turbines	FAA obstruction database
Road density	Impervious descriptor dataset

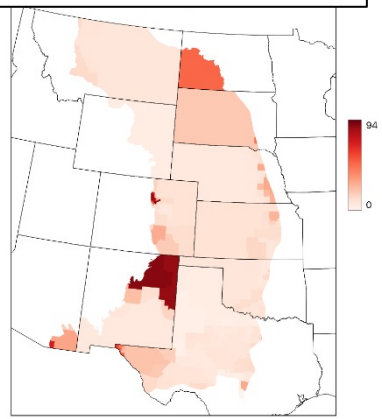


Mike Houts,
Research Associate,
KS Biological Survey

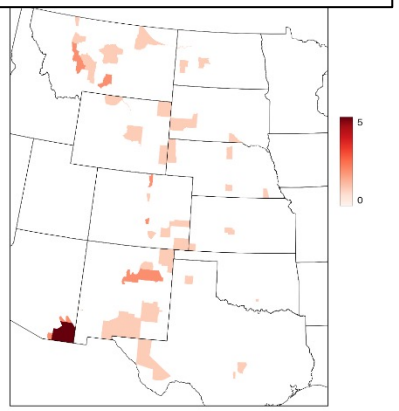
Methods (Part II): Incorporating landscape & social variables to determine conservation priorities

Social variables	Source dataset
Social willingness to embrace conservation	League of Conservation Voters
Institutional capacity to actualize conservation	Count of Land and Water Conservation Fund projects
Social willingness to embrace **prairie dog** conservation: the probability that a person would answer “increase somewhat” or “increase greatly” to “How would you like to see populations of prairie dogs change in the next 5 years?"	Prairie dog survey (Williamson et al.)

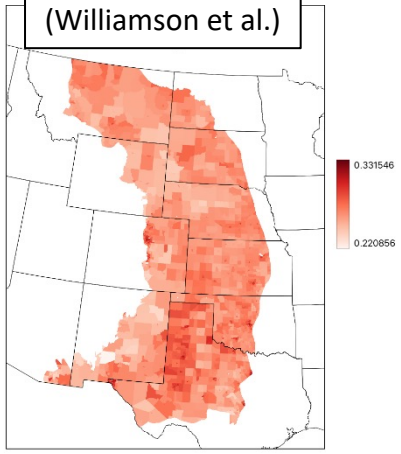
League of Conservation Voters Scorecard



Land and Water Conservation Fund Projects



BTPD Survey Data (Williamson et al.)



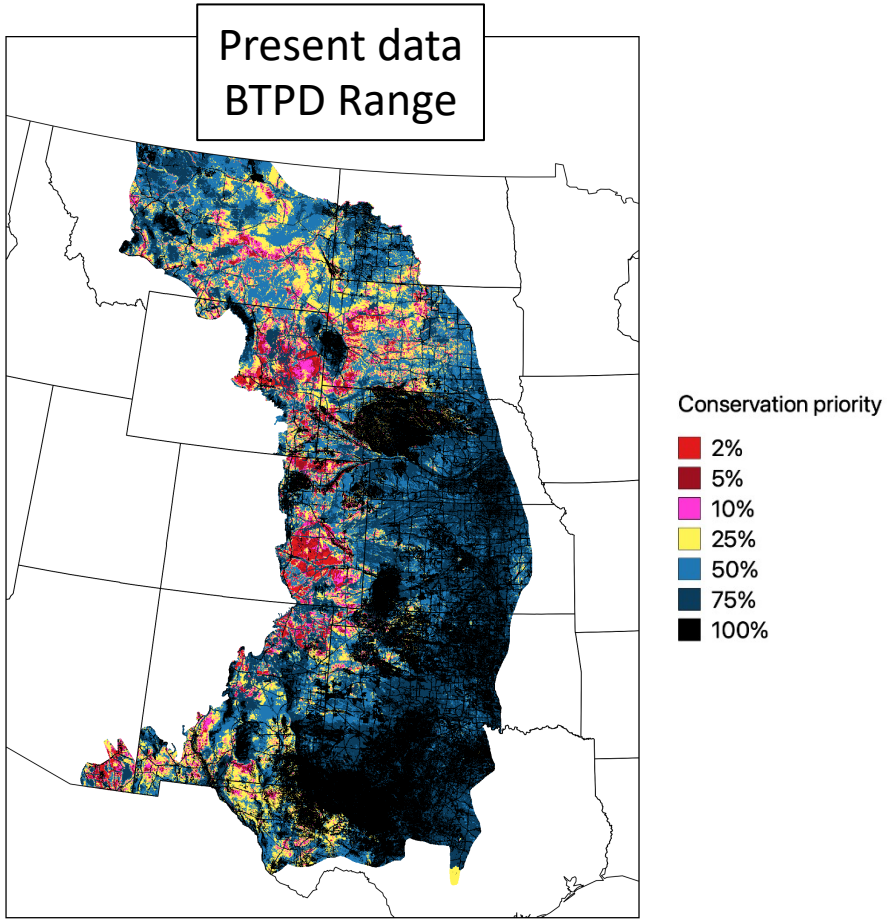
Matt Williamson,
Assistant Professor,
Boise State University

Methods (Part II): Identifying current & future priority areas within predicted suitable habitat

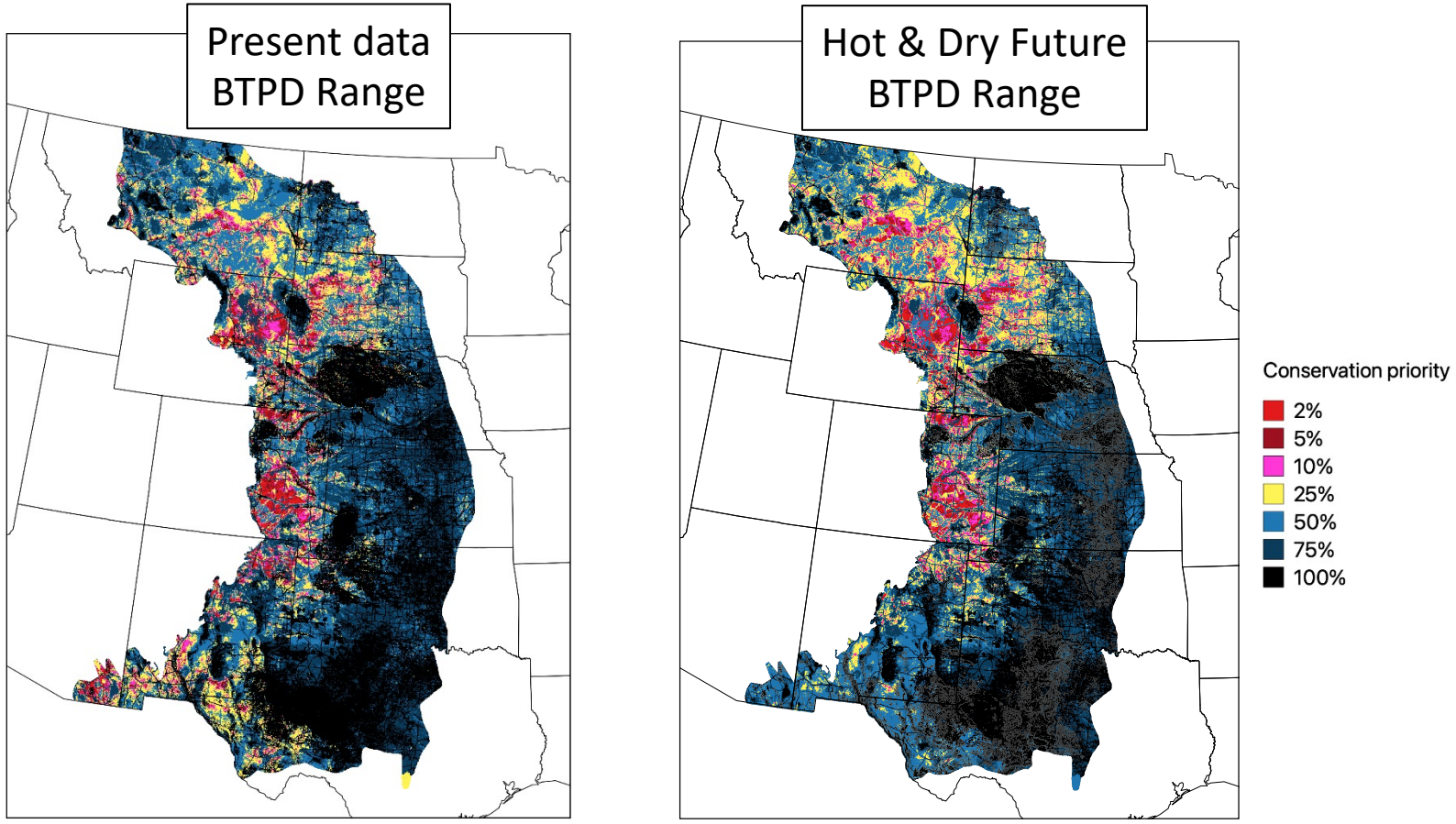
Multiple scenarios and prioritization informed by expert and manager input & engagement



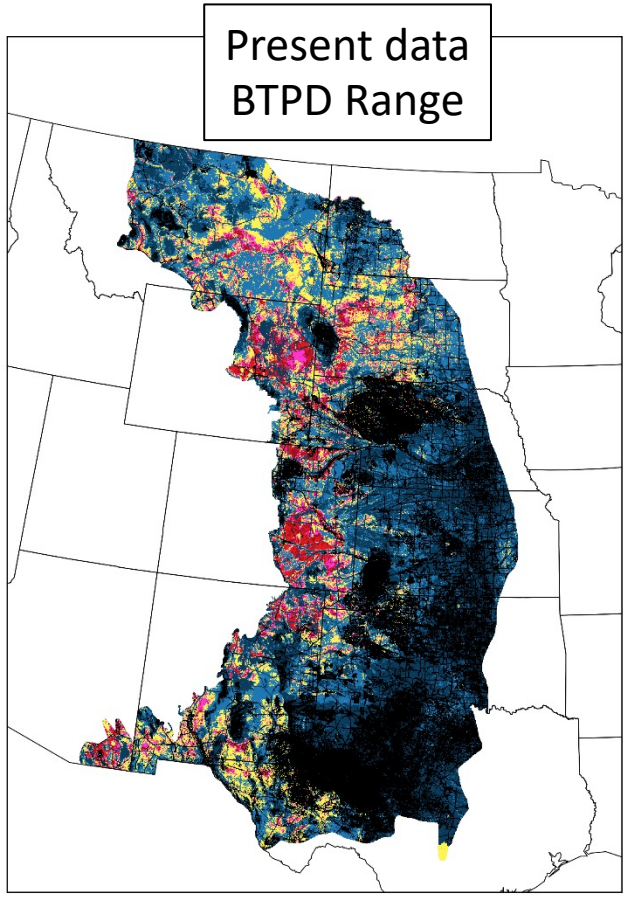
Results (Part II): Identifying current & future priority areas within predicted suitable habitat

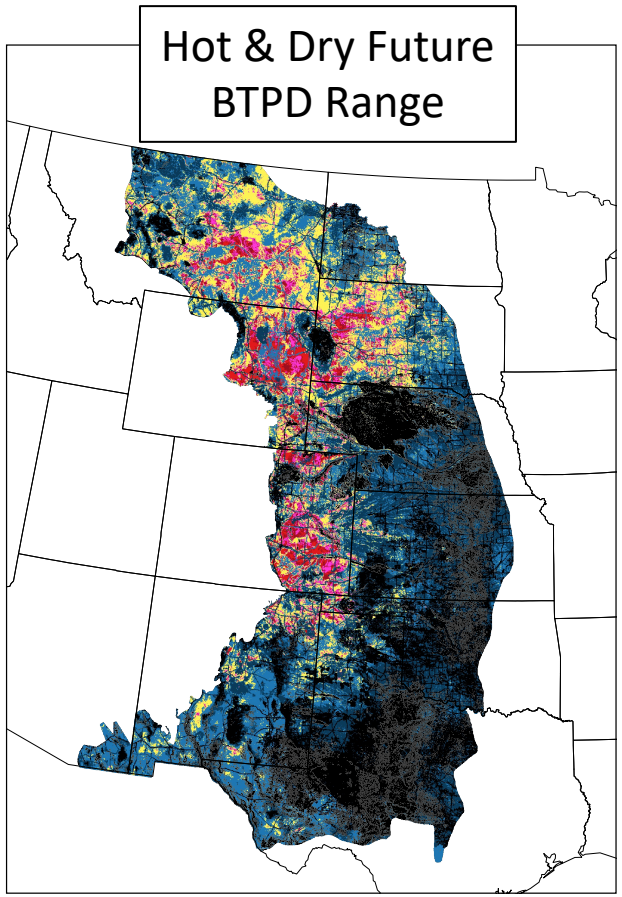


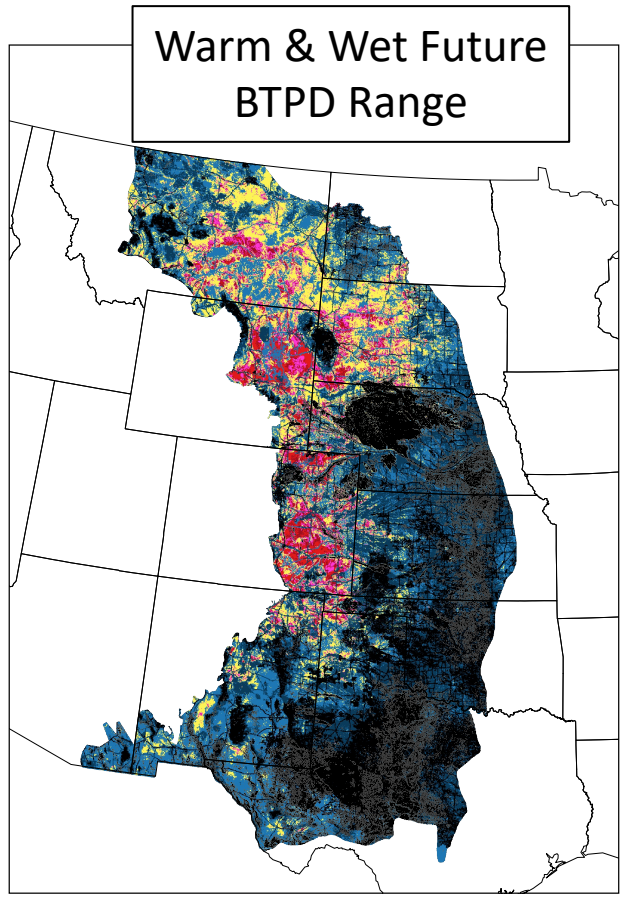
Results (Part II): Identifying current & future priority areas within predicted suitable habitat



Results (Part II): Identifying current & future priority areas within predicted suitable habitat



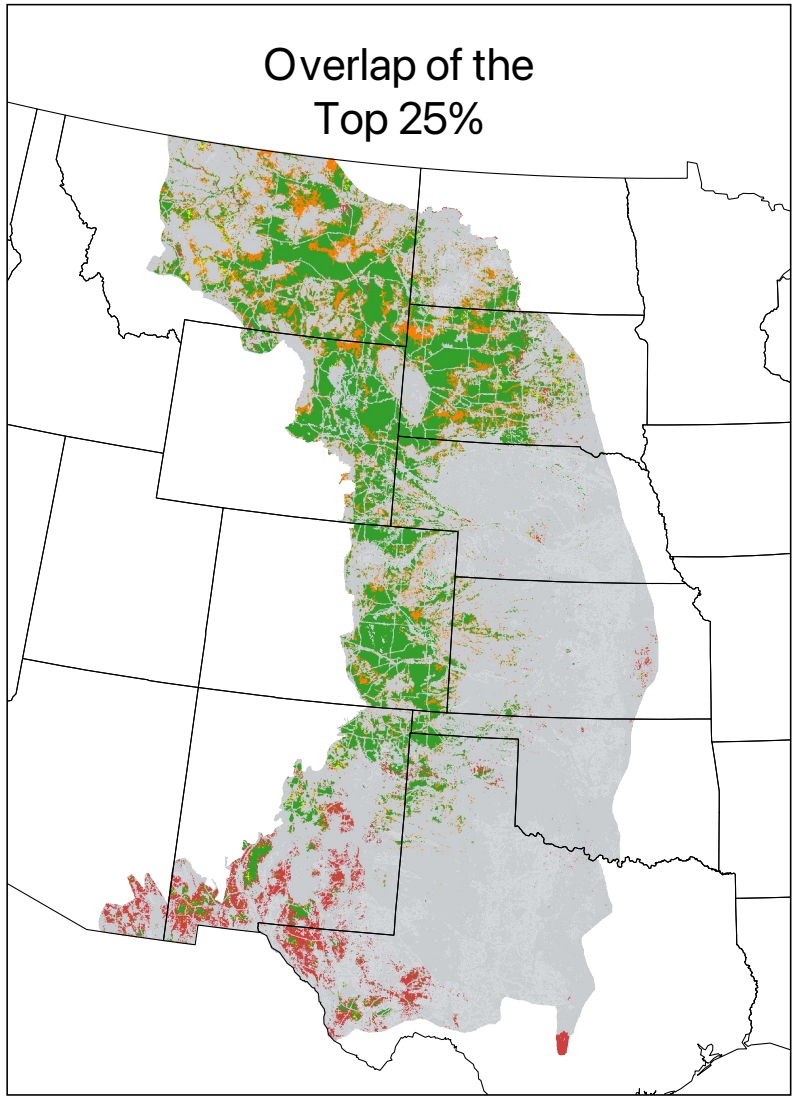




Conservation priority
- 2%
- 5%
- 10%
- 25%
- 50%
- 75%
- 100%

Results (Part II): Identifying the top 25% across current and future scenarios

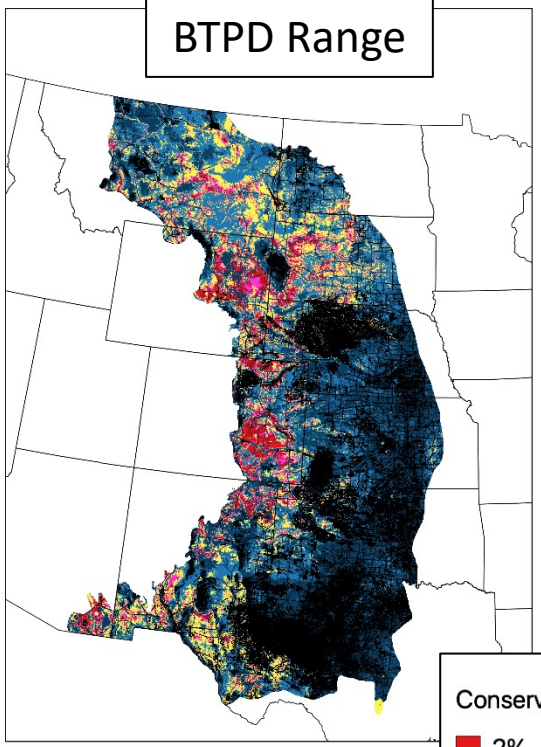
** the green area covers 20% (**28,647,110 ha)** of the BTPD range



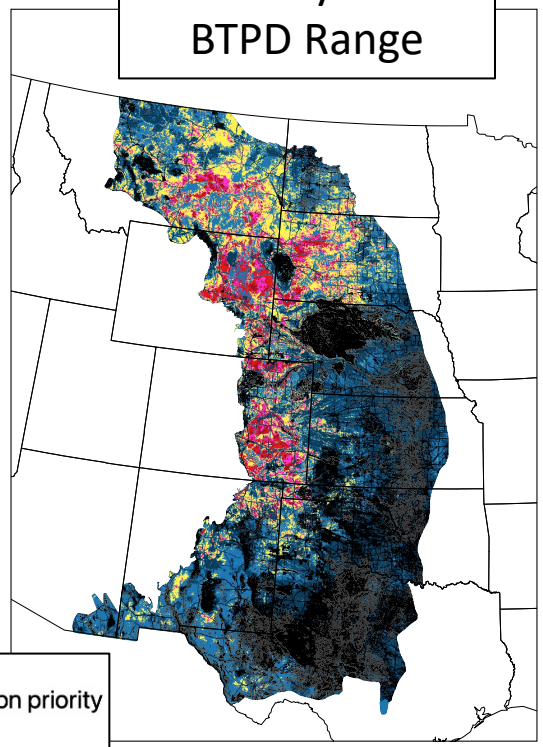
Top 25% priorities
- Only for present
- Only for future scenarios (W&W and/or H&D)
- Present and one of the future scenarios (W&W or H&D)
- Overlapped

Results (Part II): Identifying current & future priority areas and the top 25% across all

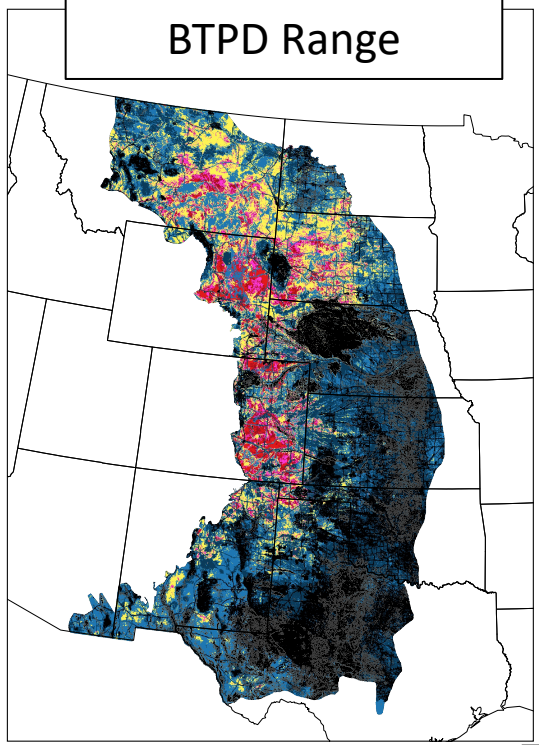
Present data BTPD Range



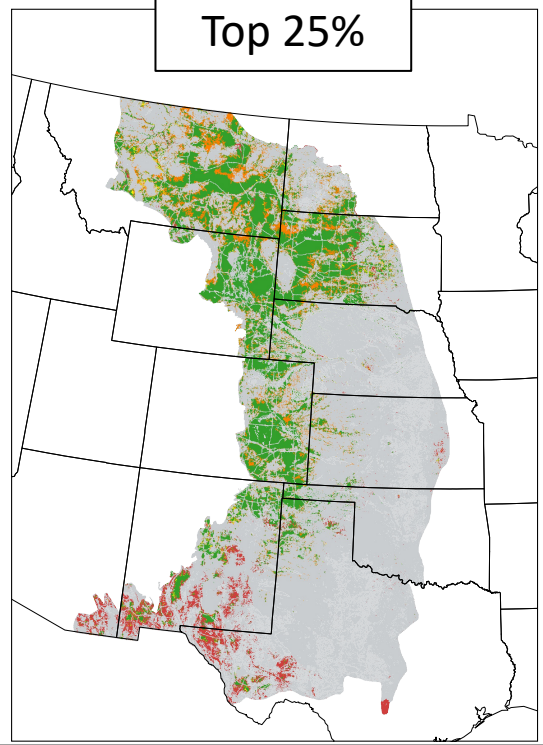
Hot & Dry Future BTPD Range



Warm & Wet Future BTPD Range



Overlap of Top 25%

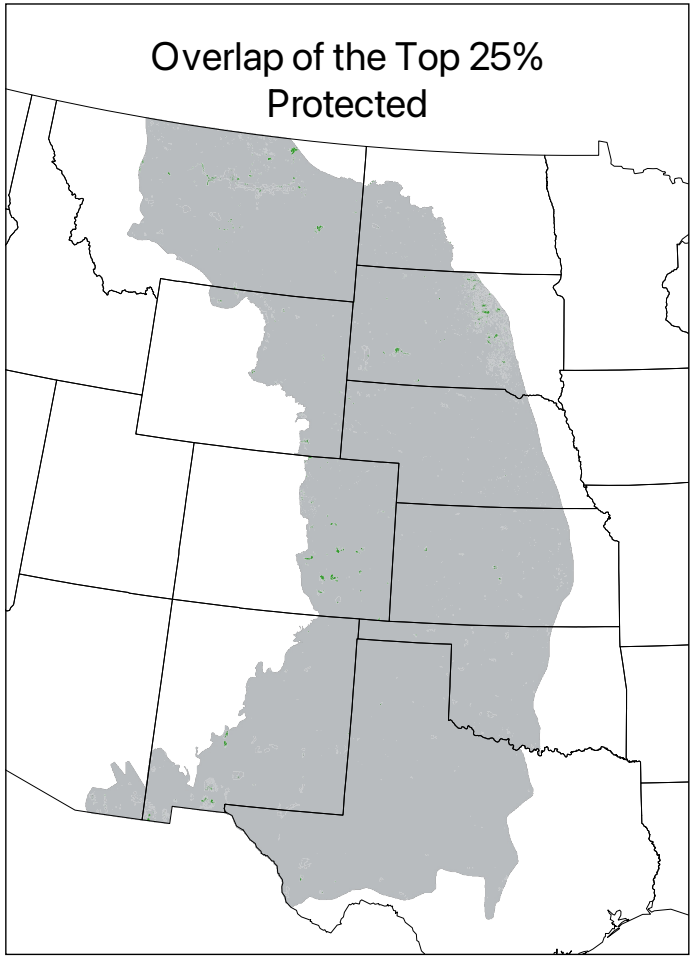


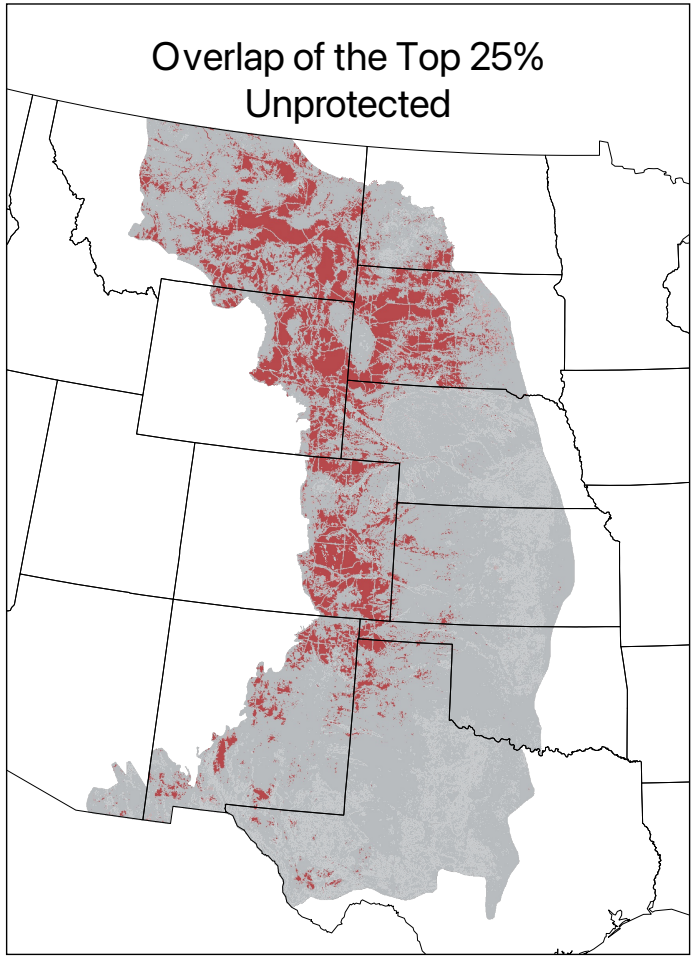
Conservation priority
- 2%
- 5%
- 10%
- 25%
- 50%
- 75%
- 100%

Top 25% priorities
- Only for present
- Only for future scenarios (W&W and/or H&D)
- Present and one of the future scenarios (W&W or H&D)
- Overlapped

Results (Part II): How the top 25% priority areas relate to lands already managed for conservation

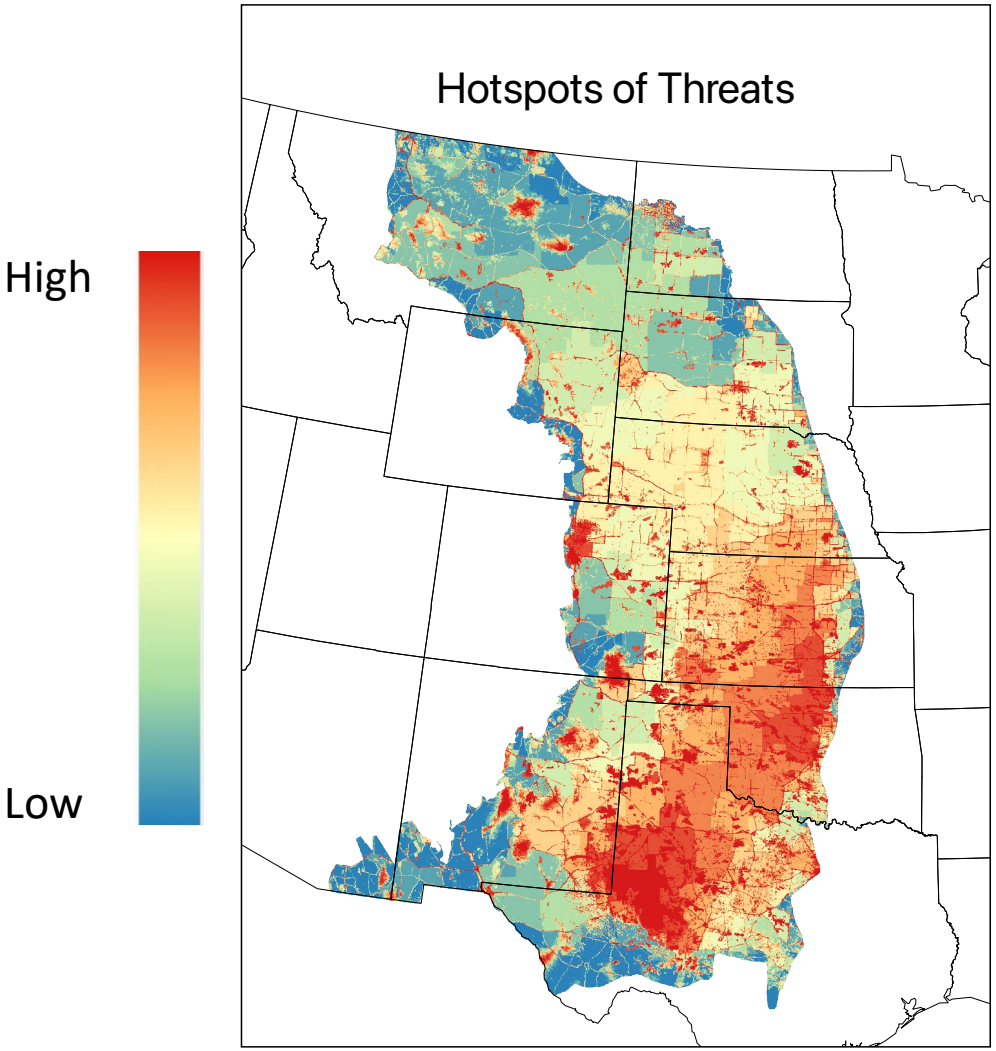
** the green area covers 0.2% (547,398 ha) of the BTPD range





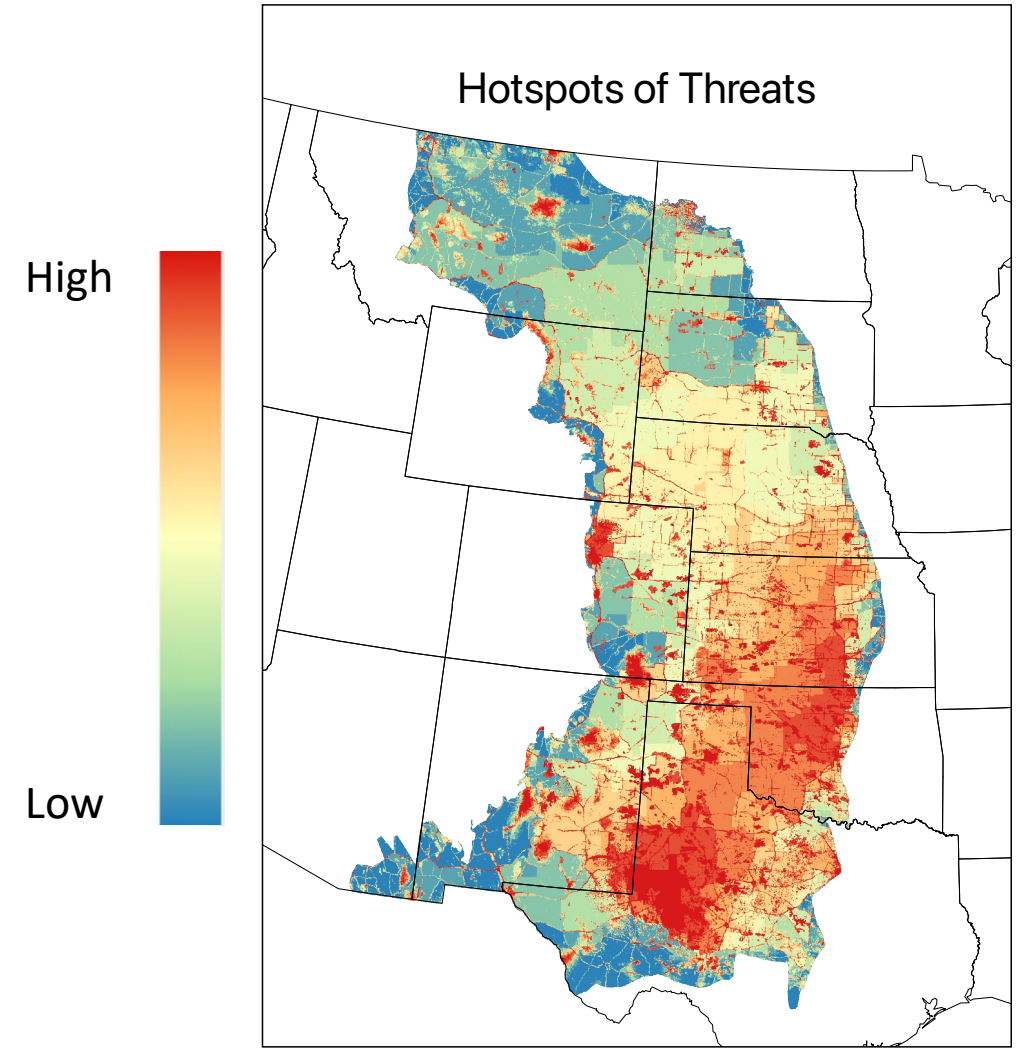
** the red area covers 17.8% (28,099,710 ha) of the BTPD range

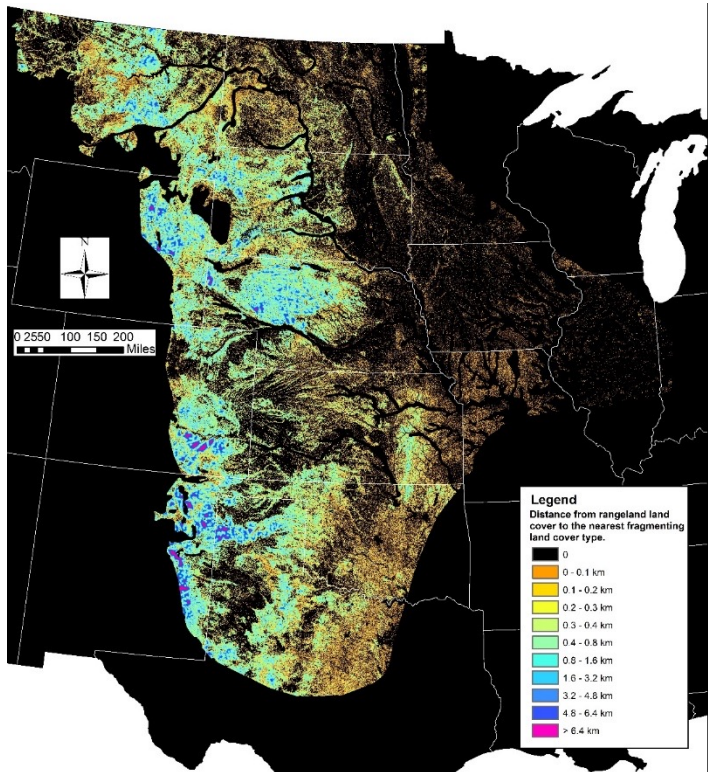
Results (Part II): Identifying current hotspots of threat across the BTPD range



Landscape "Threat" variables
Landuse change
Landscape fragmentation
Tillage risk
Oil/gas wells
Wind power
Distance to Transmission lines
Road density
% tree cover

Results (Part II): Identifying current hotspots of threat across the BTPD range

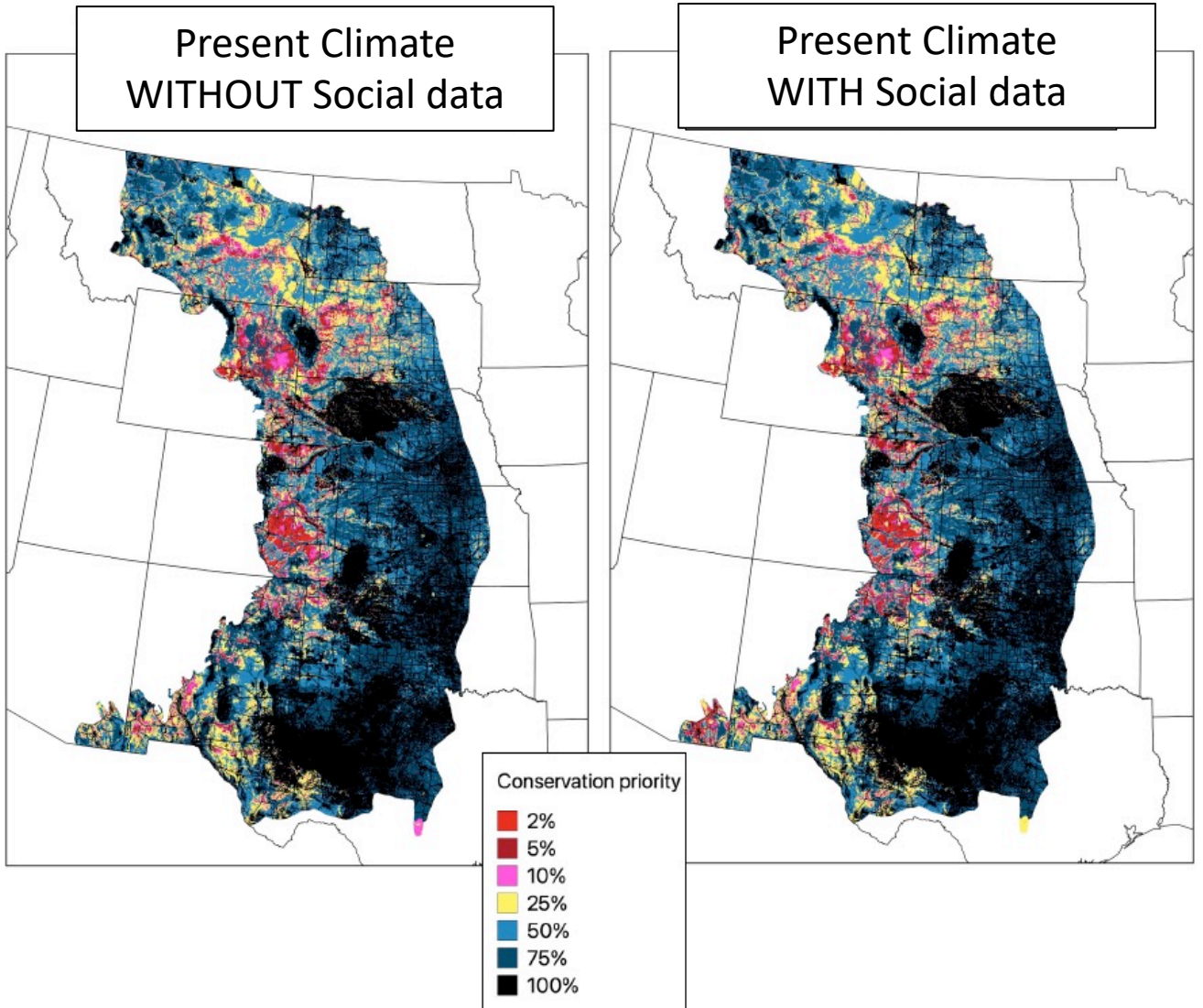




Great Plains Landscape fragmentation

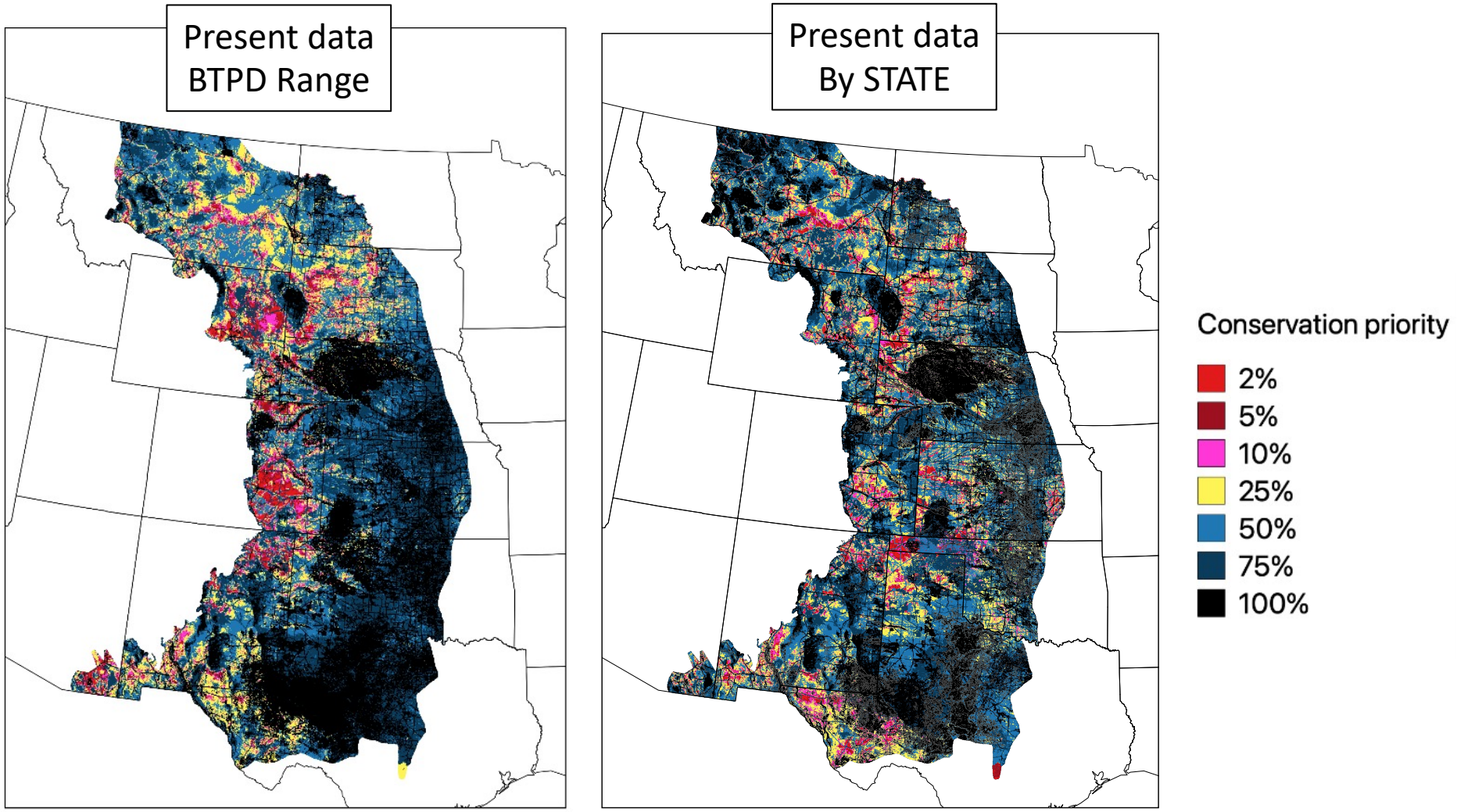
Augustine et al., 2019, *Rangeland Ecology*

Results (Part II): Identifying current priority areas across range, without and with social layer

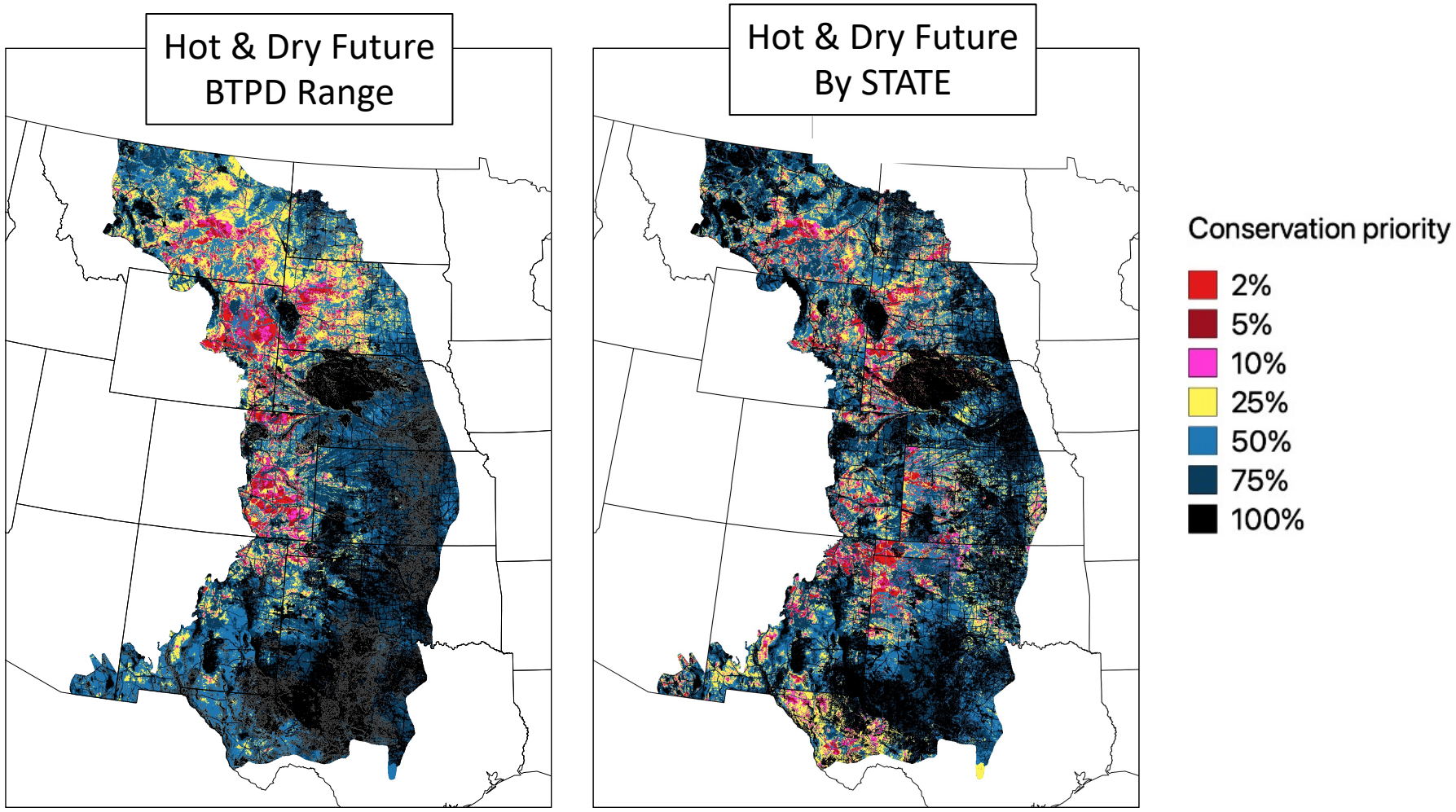


Results (Part II): Looking at priority areas by State

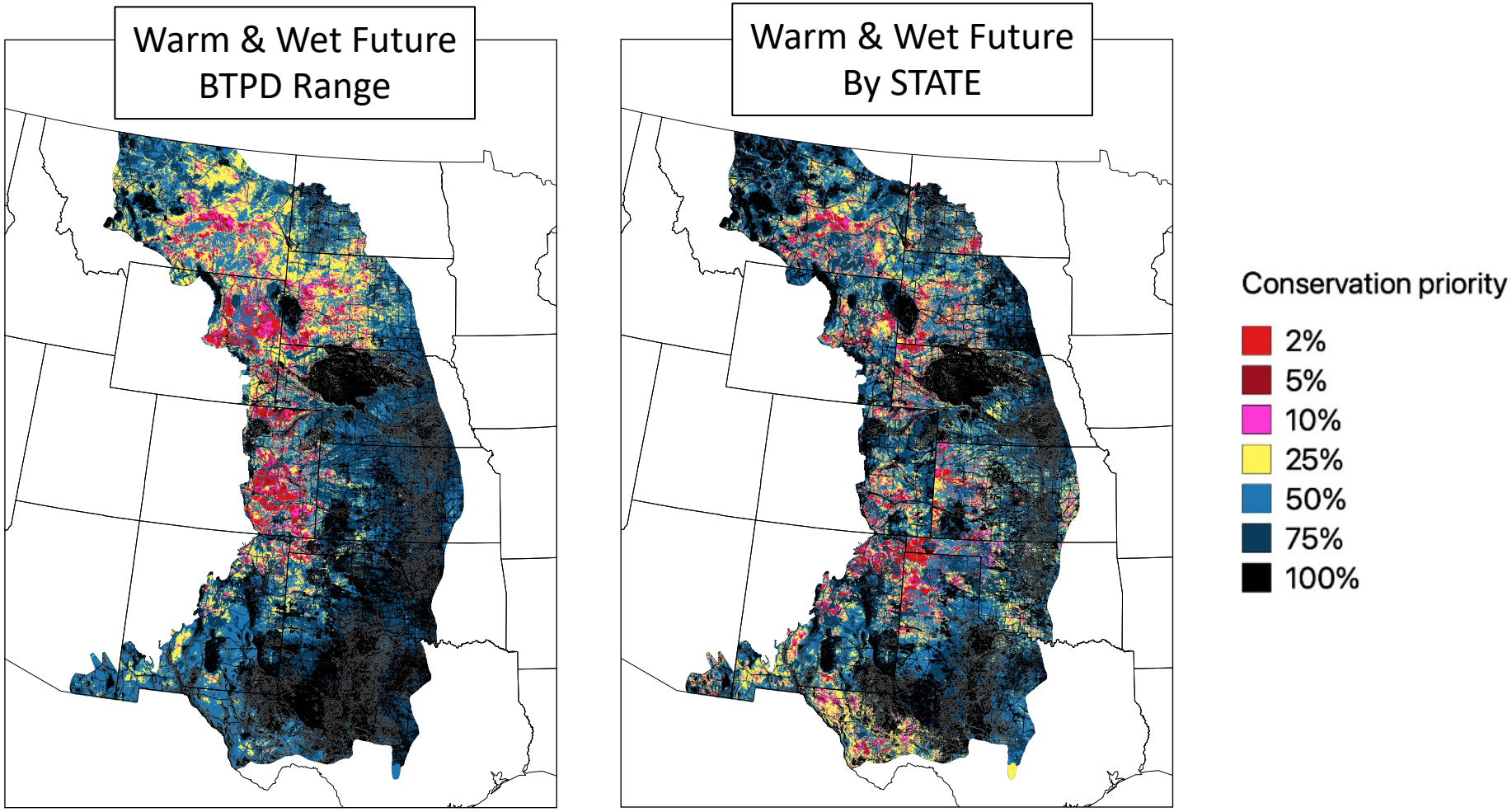
Results (Part II): Identifying current priority areas across BTPD range and by State



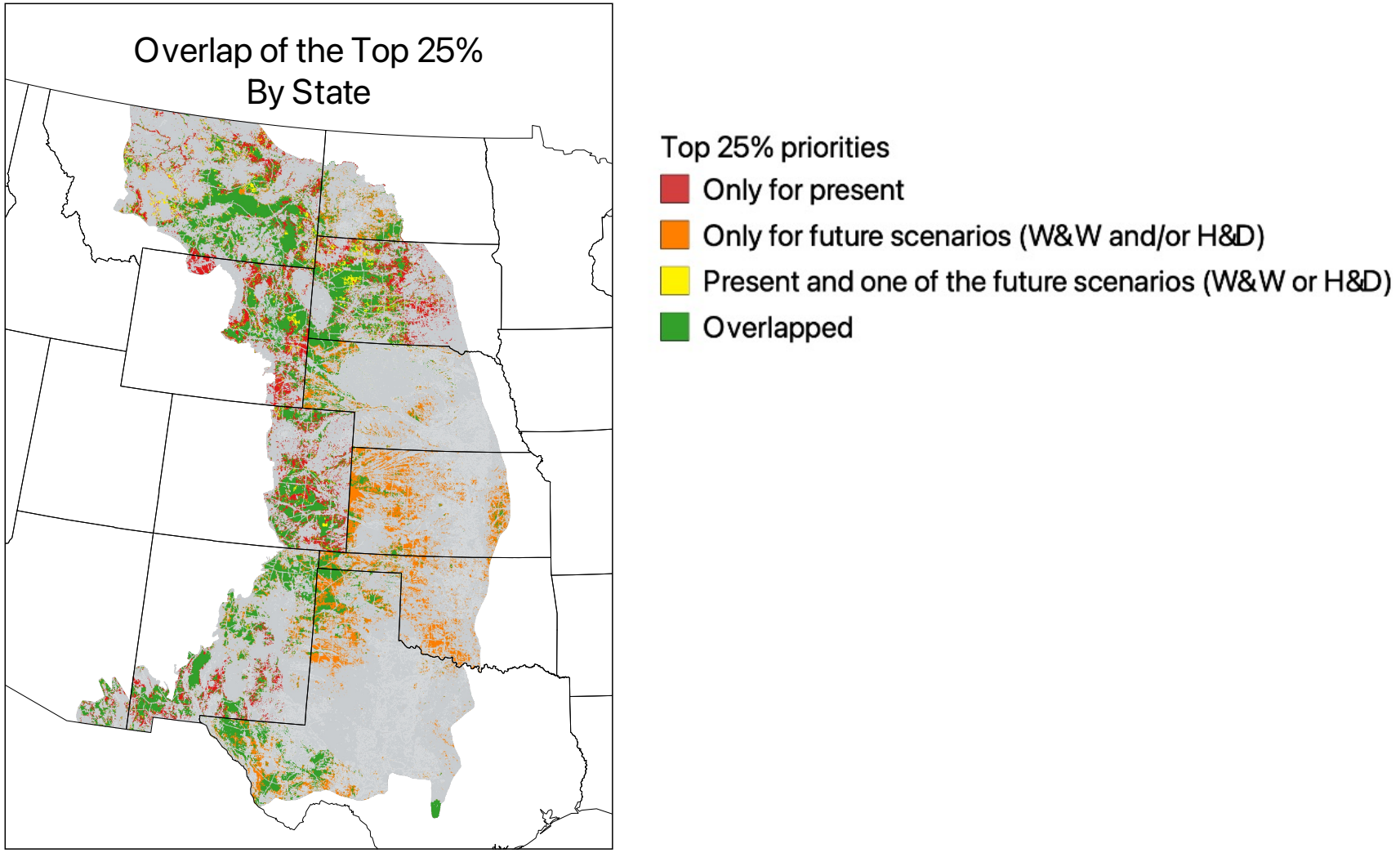
Results (Part II): Identifying future (hot & dry) priority areas across BTPD range and by State



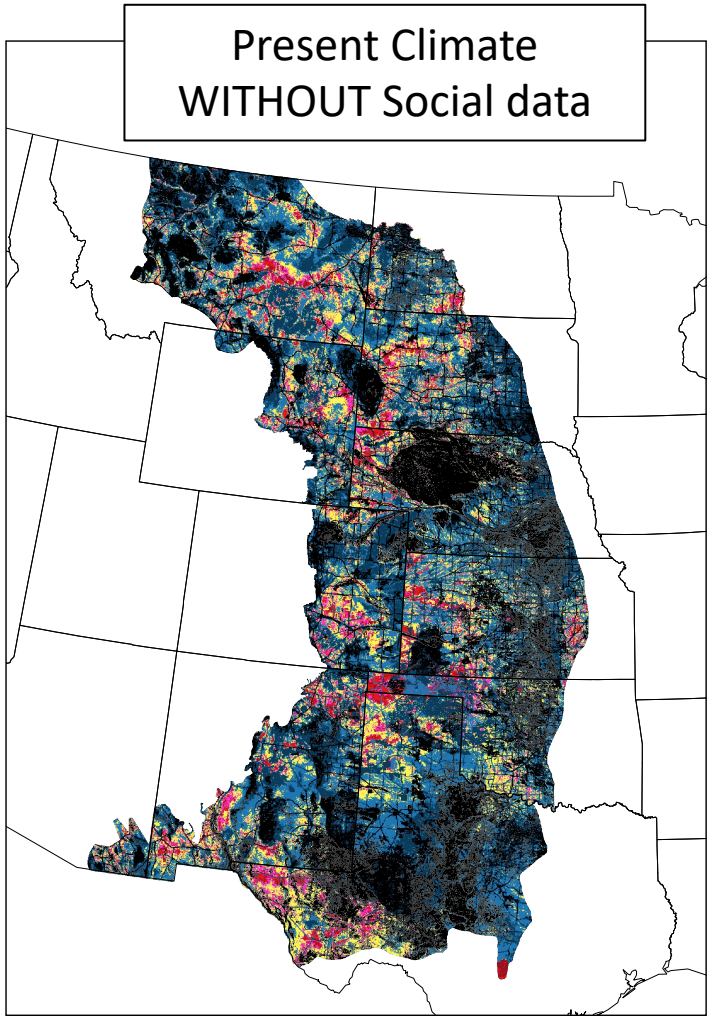
Results (Part II): Identifying future (warm & wet) priority areas across BTPD range and by State

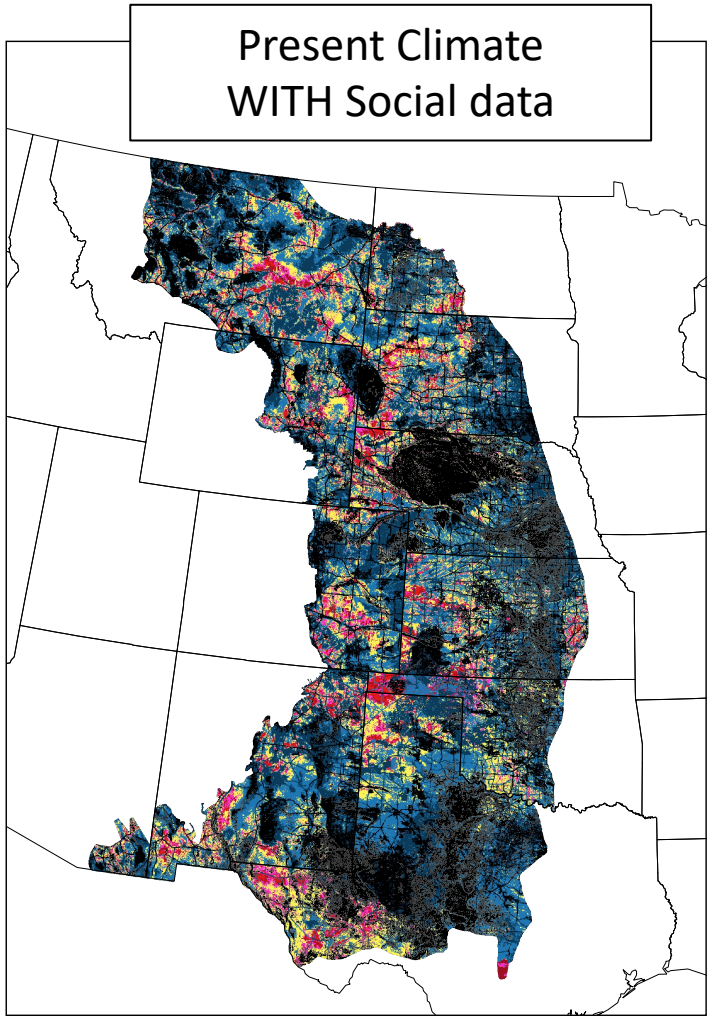


Results (Part II): Identifying the top 25% across current and future scenarios, by State



Results (Part II): Identifying current priority areas by State, without and with social layer



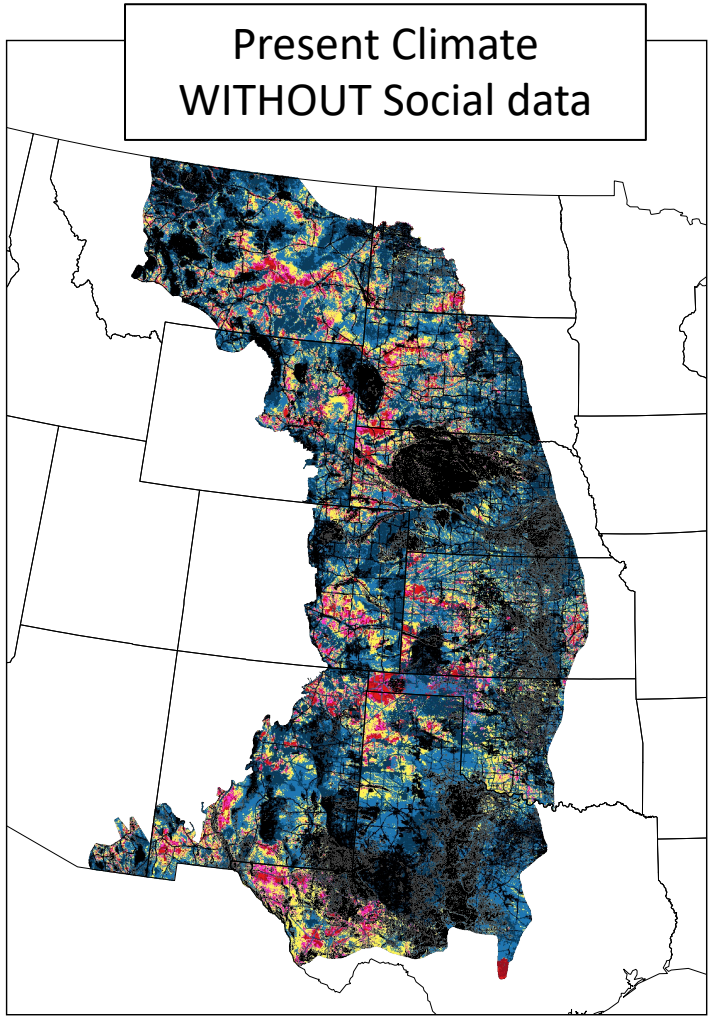


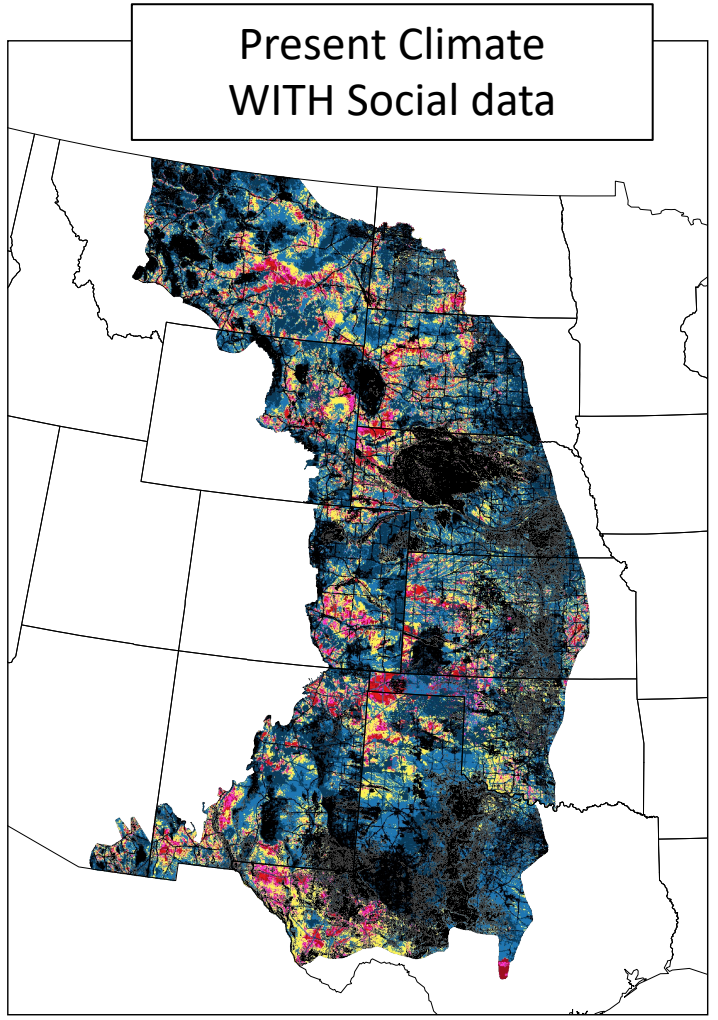
Conservation priority

- 2%
- 5%
- 10%
- 25%
- 50%
- 75%
- 100%

Results (Part II): Identifying current priority areas by State, without and with social layer

Fernanda Thiesen Brum,
Postdoctoral Fellow,
Universidade Federal do Paraná – Brazil





Conservation priority

- 2%
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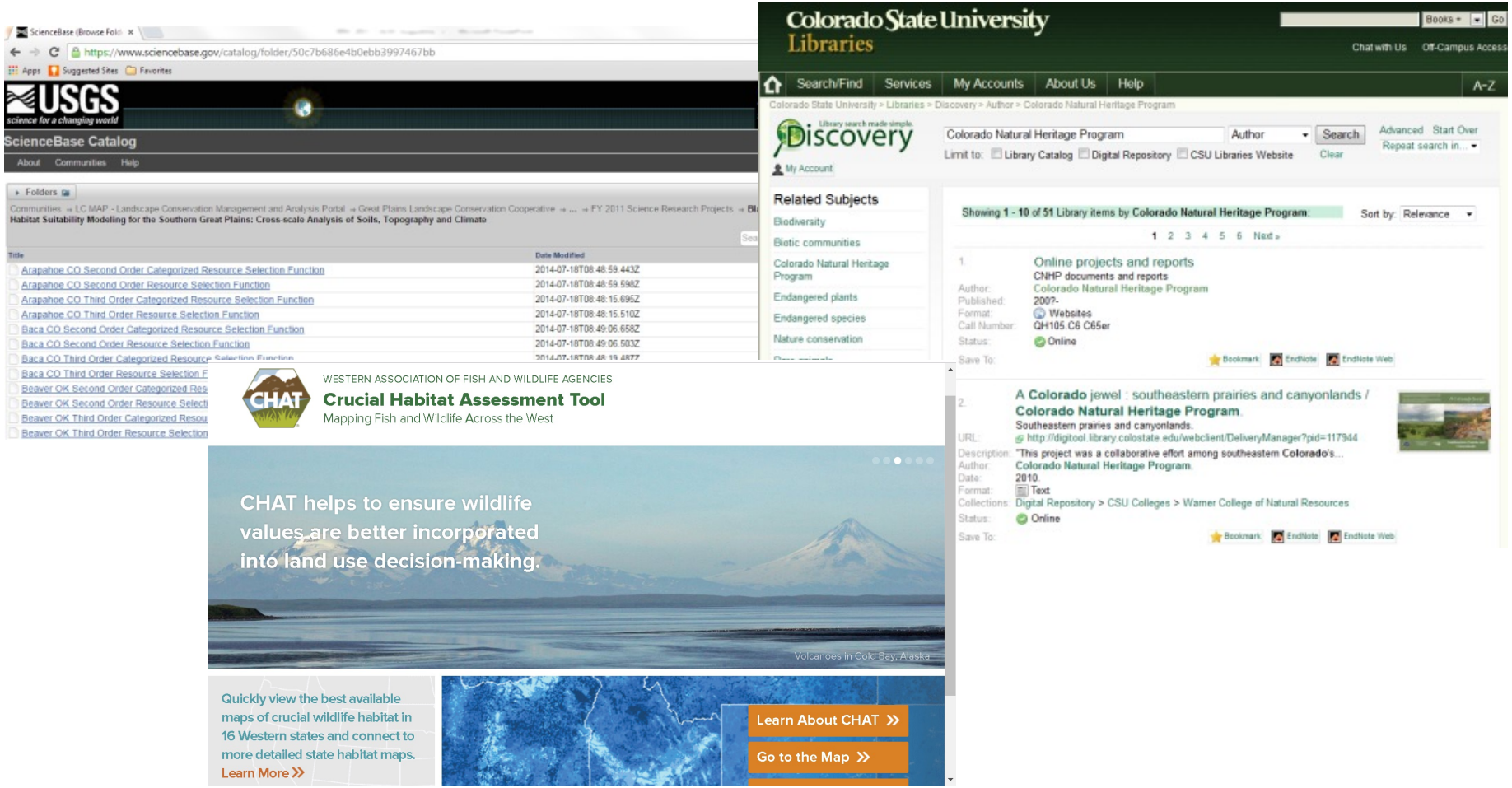
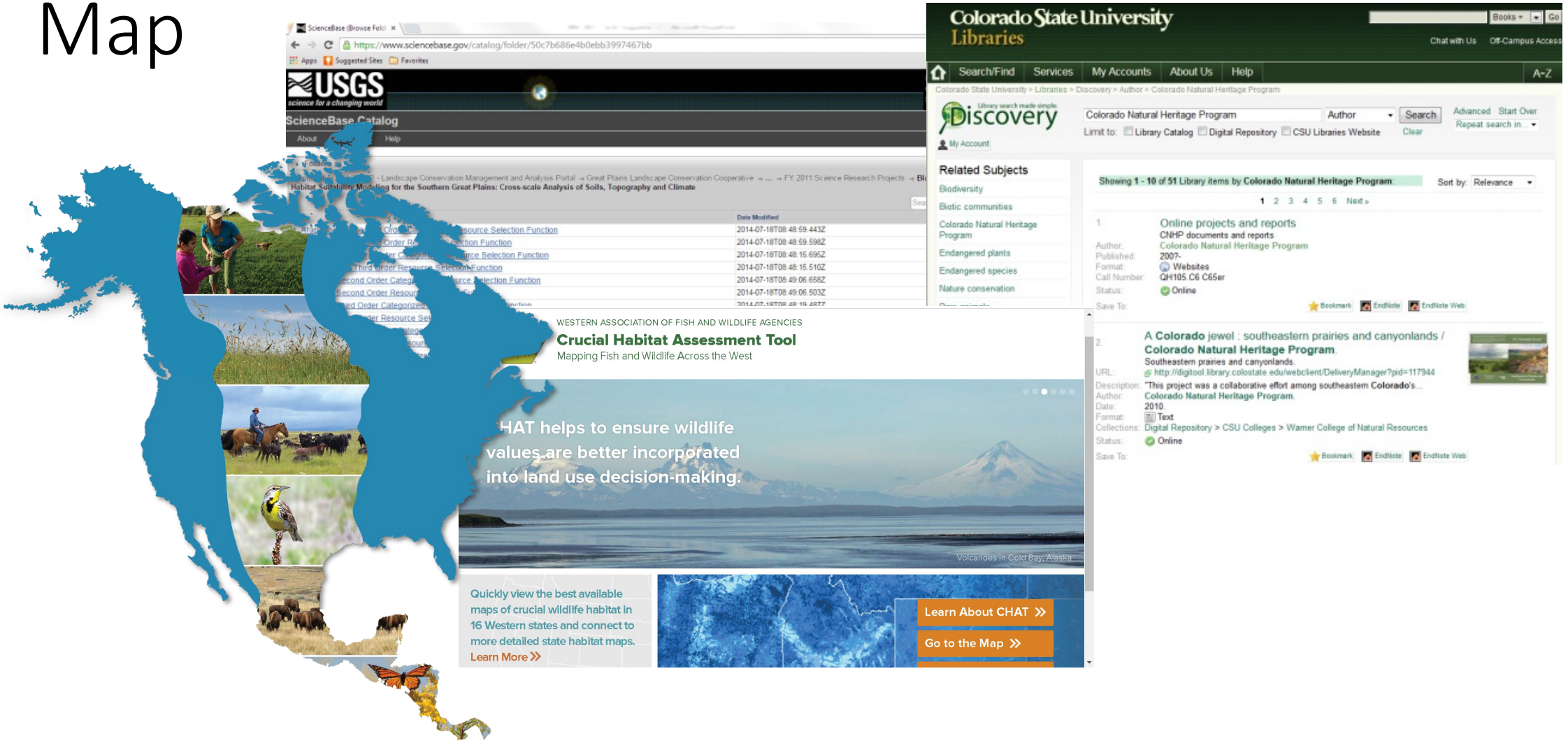
- 75%
- 100%

Results will be available in Online Portals, to the Central Grasslands Roadmap & in an online Web Map



Results will be available in Online Portals, to the Central Grasslands Roadmap & in an online Web Map



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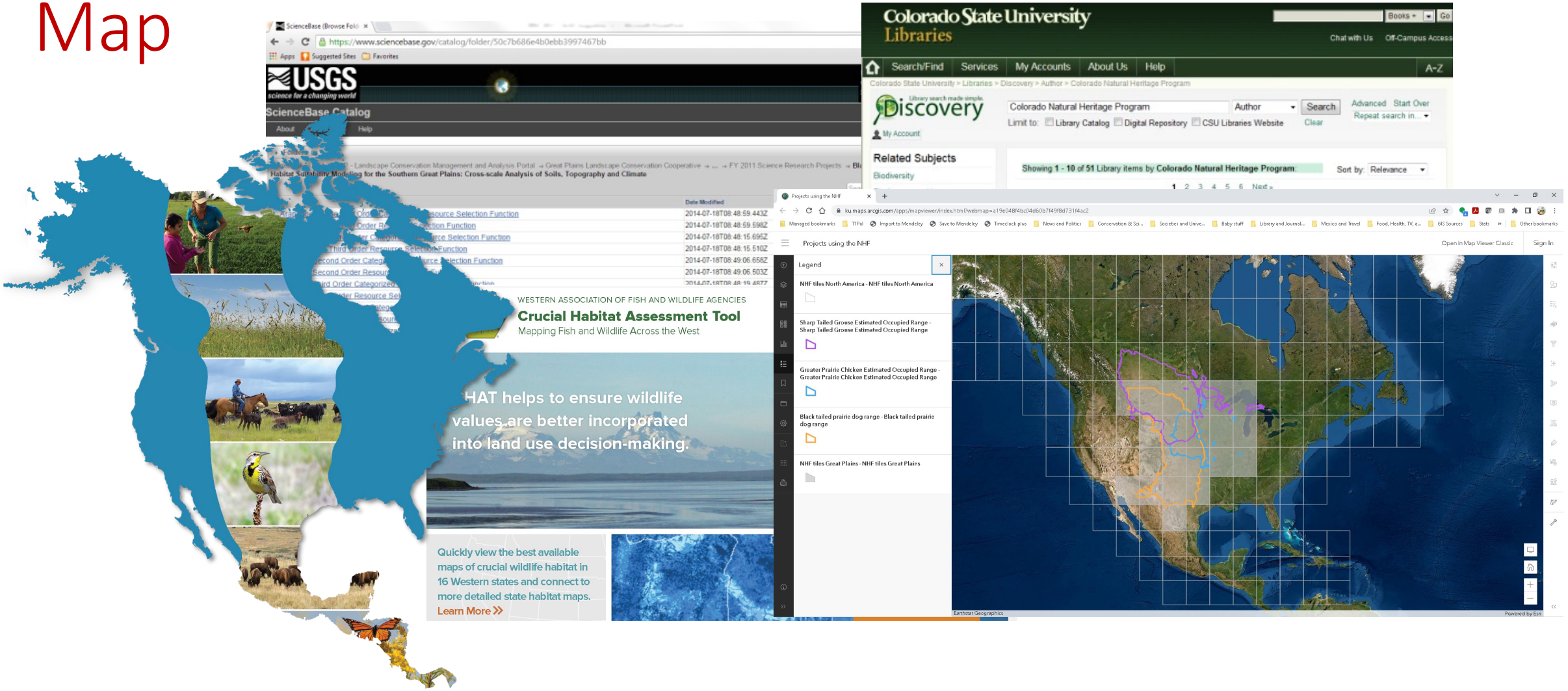


Partners

BOISE STATE
UNIVERSITY

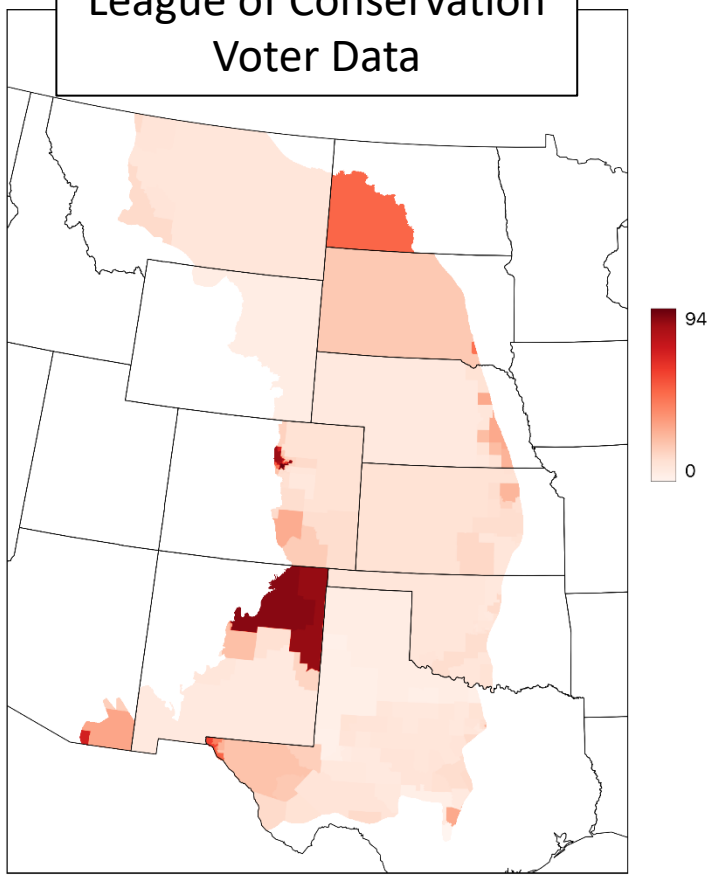
THE HUMANE SOCIETY
OF THE UNITED STATES

Questions?

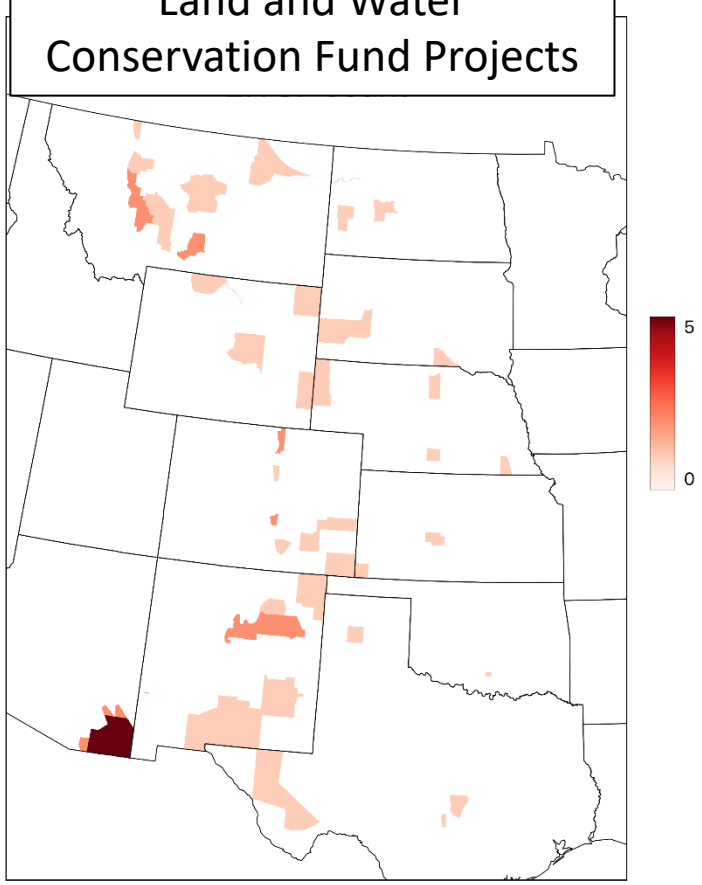
Photo by Rodrigo Sierra Corona

Results (Part II): Social Variables

League of Conservation Voter Data



Land and Water Conservation Fund Projects



BTPD Survey Data (Williamson et al.)