Climate Change Vulnerability Assessments



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Hothouse Earth

Planetary tipping point

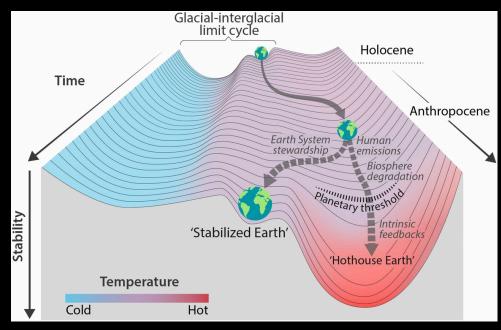
Warmer temperatures

Mega droughts

Flooding

Earlier springs

Loss of snow



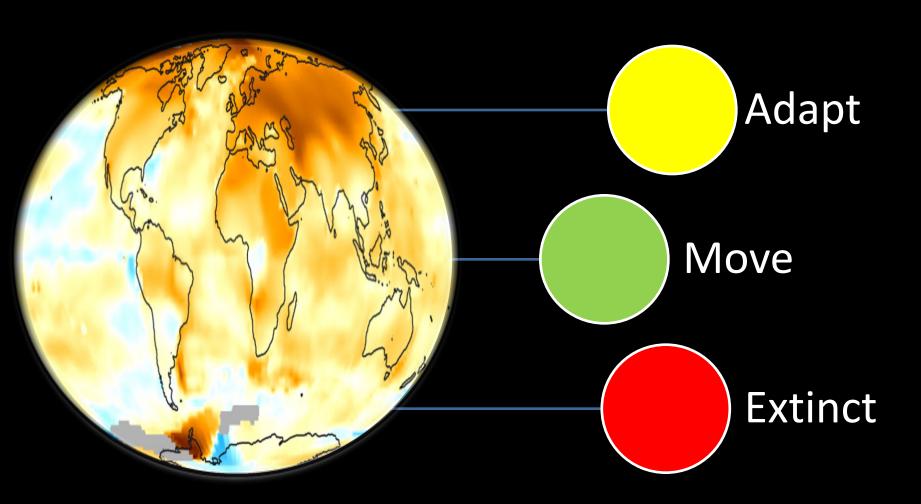








How will species respond?



Climate Change Vulnerability



Propensity to be adversely affected by climate change, including (but not limited to) decreases in abundance, loss of genetic variation, local extirpation, and extinction. Vulnerability is partitioned into three components:

Sensitivity • Exposure • Adaptive Capacity

Components of Vulnerability

Sensitivity

Degree to which a species or system is likely to be affected by or responsive to climate variability or change

- Demography
- Physiology
- Interactions
- Range changes
- Phenology
- Indirect or indirect
- Positive <u>or</u> negative

Components of Vulnerability Exposure

A population's exposure reflects the character, magnitude, and rate of historic or future climate change for a specific region or place

- Seasonality
- Temperature
- Precipitation
- Extreme events

Components of Vulnerability

Adaptive Capacity

Ability of a species or system to accommodate or cope with climate change.

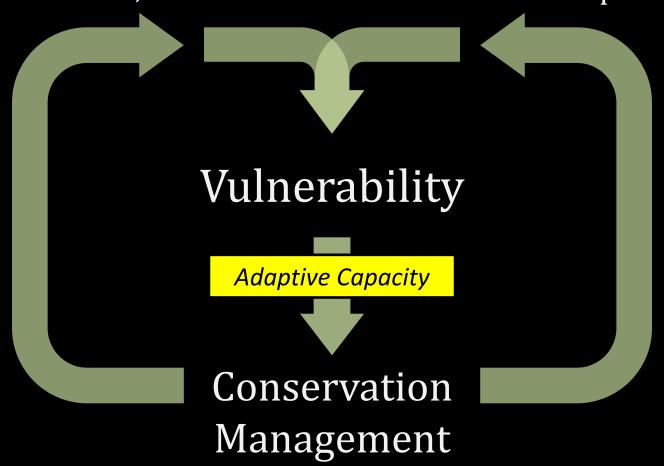
- Dispersal capabilities
- Evolutionary adaptation
- Behavioral adaptation
- Phenological plasticity
- Phenotypic plasticity
- Specialists vs generalists

Sensitivity

Physical limits, habitat specialization, interactions

Exposure

Means and extremes over time and space



Climate Change Vulnerability Assessments

CCVA meant to...

synthesize and integrate scientific information incorporate quantitative analyses & expert-derived information

determine degree to which species or communities of interest are susceptible to the effects of climate change

Steps for carrying out a CCVA

Step 1 Define goals and objectives

- Which species are most vulnerable?; How are species vulnerable?
- Why are species vulnerable?; Where are species vulnerable?
- When is the species most vulnerable?

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Step 2 Identify all likely impacts

- Climate impacts (Seasons? Variables? Short or Long-term)
- Mechanisms

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- Climate impacts (Seasons? Variables? Short or Long-term)
- Mechanisms (Directionality)

Step 3 Quantify these impacts

- Trait-based assessment [Ranking species]
- Correlative assessment [Distributional changes]
- Mechanistic assessment [Extinction probability]

What is the vulnerability of grassland birds to climate change?

Collaborators: Christine Ribic, Lisa McCauley, Scott Maresh Nelson, Jacy Bernath-Plaisted, Neal Niemuth

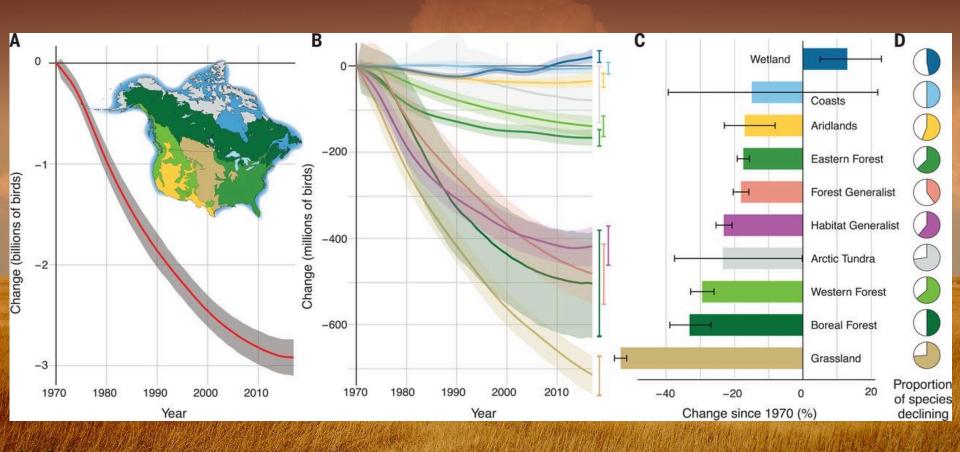
Agencies: National Climate Adaptation Science Center, Midwest Climate Adaptation Science Center, Northeast Climate Adaptation Science Center







Grassland Bird Declines



Grassland Birds

720
MILLION
GRASSLAND BIRDS
LOST SINCE 1970

-53%

POPULATION LOSS IN GRASSLAND BIRDS SINCE 1970



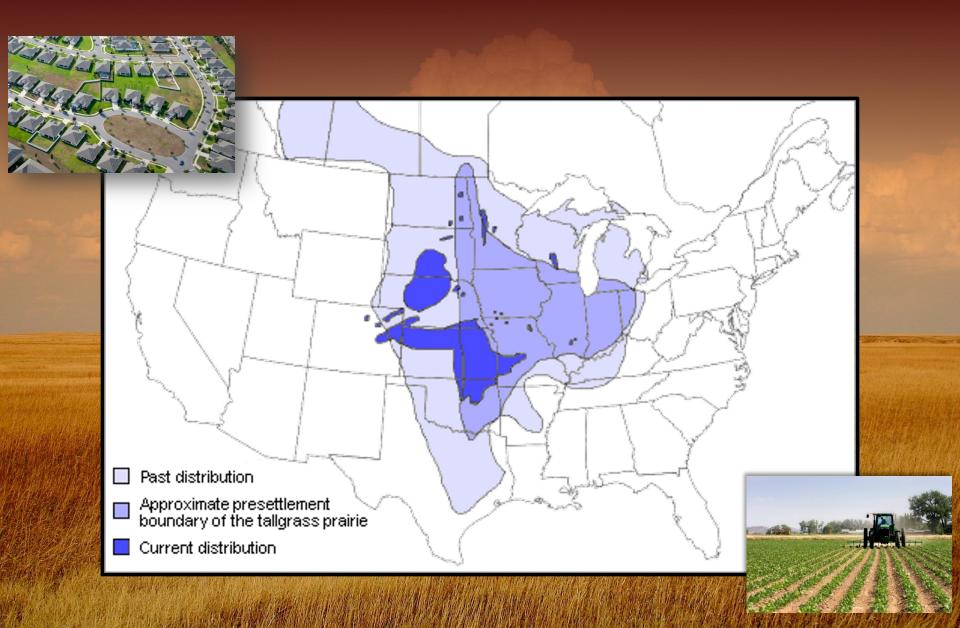


Half of grassland birds will face additional climate pressures

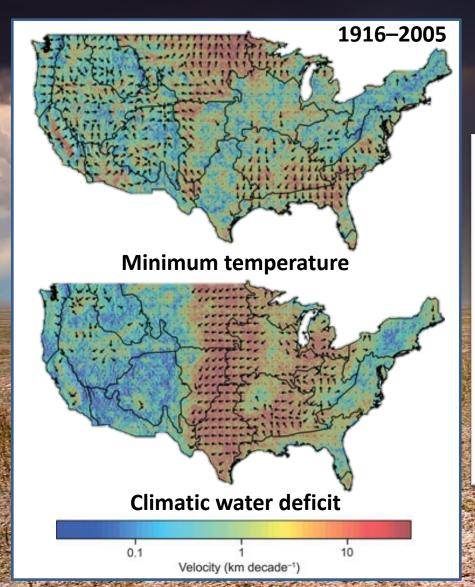
Grasslands becoming drier and more exposed to extremes

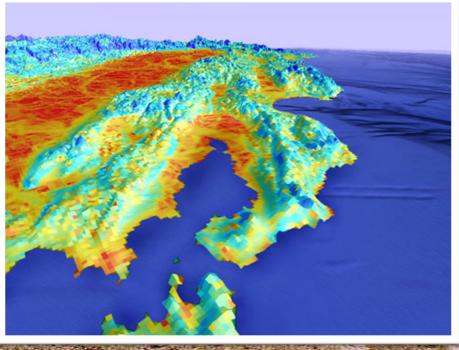
Common species are of concern

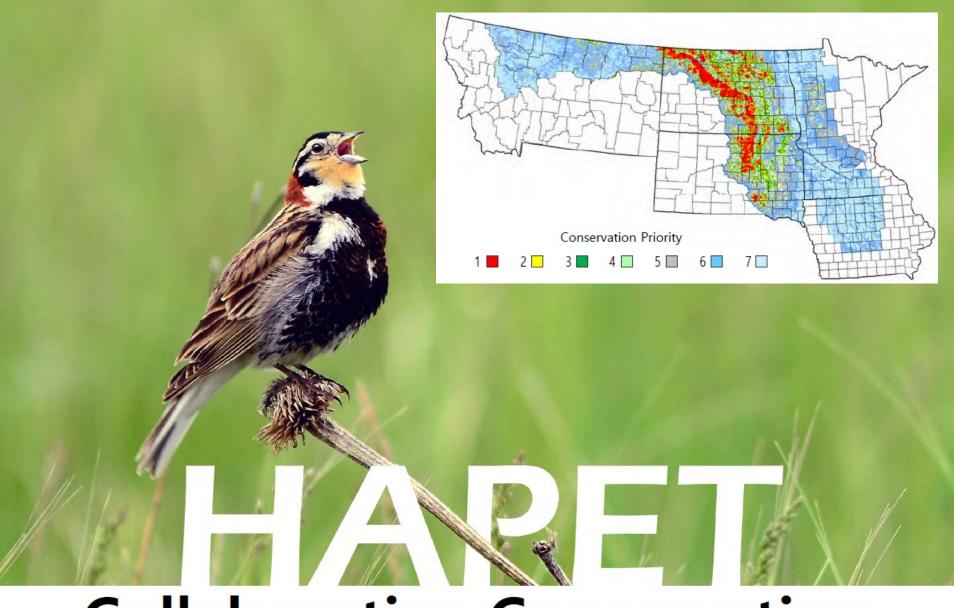
Loss of Grassland Habitat



Climate Change in Grasslands







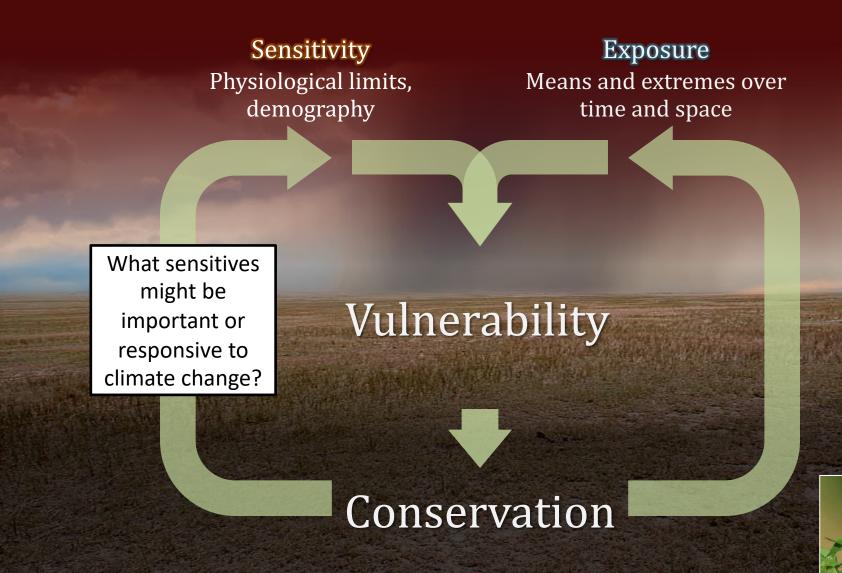
Collaborative Conservation for Grassland Birds

Henslow's Sparrow

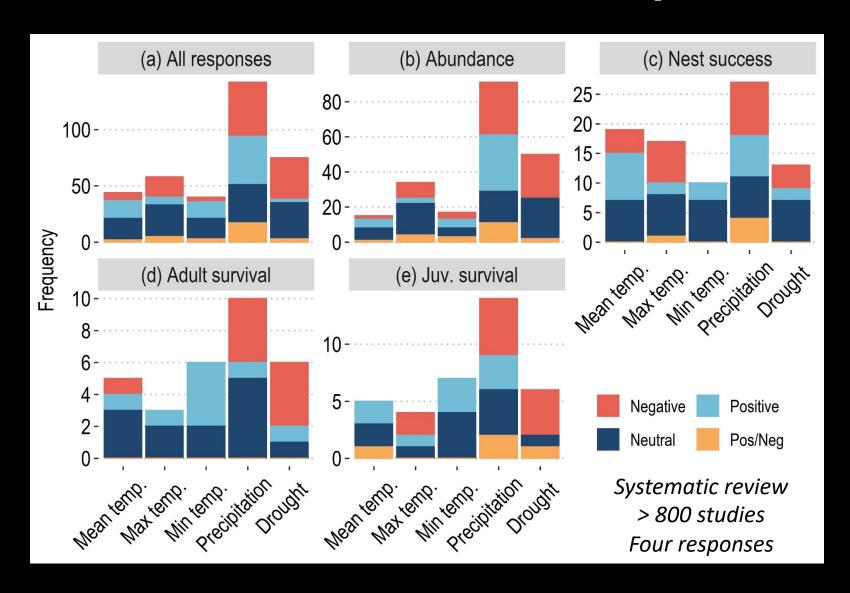


Conservation concern • Short-distance migrant • Insects in summer; seed in winter

Climate Change Vulnerability

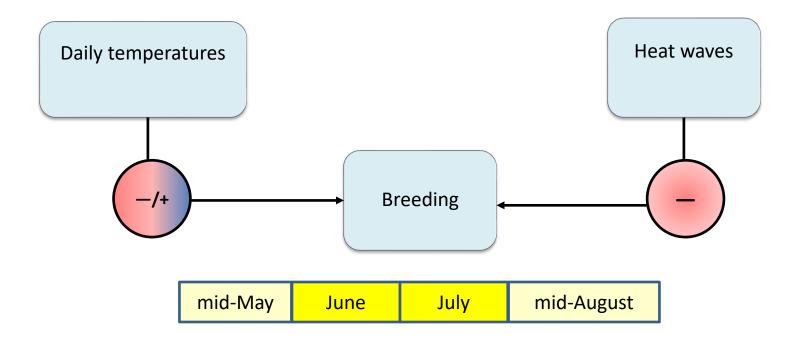


Climate Sensitivity



CONCEPTUAL MODEL BREEDING:

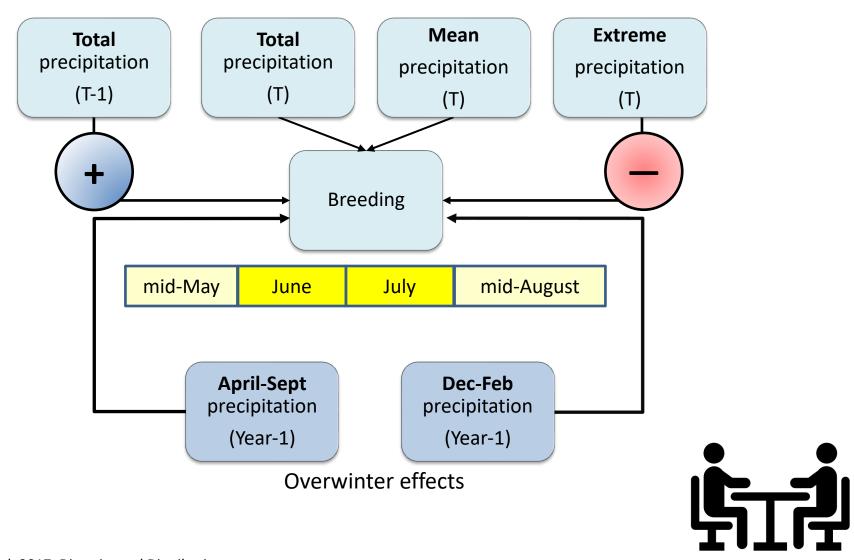
TEMPERATURE



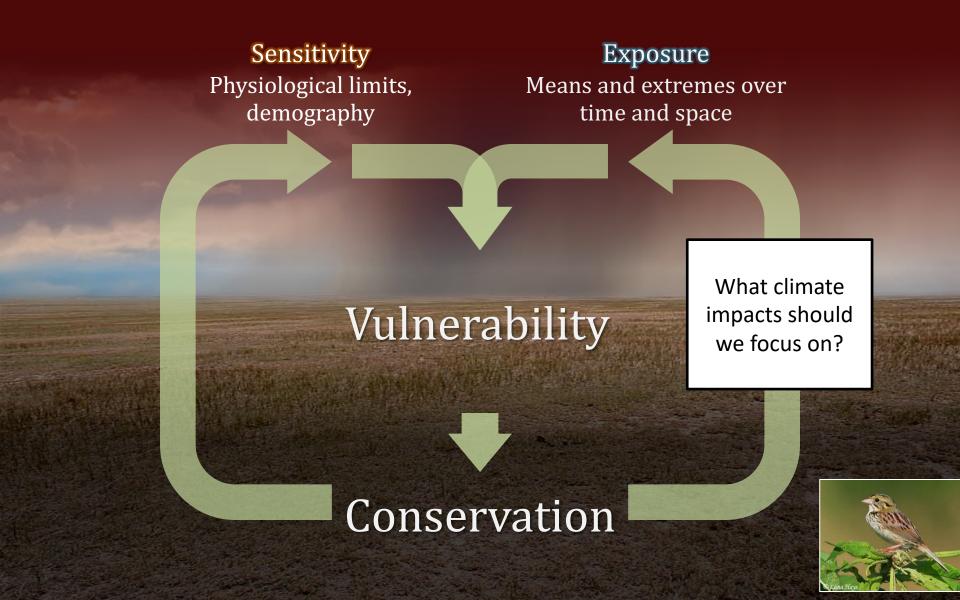


CONCEPTUAL MODEL BREEDING:

PRECIPITATION



Climate Change Vulnerability



Demographic Database

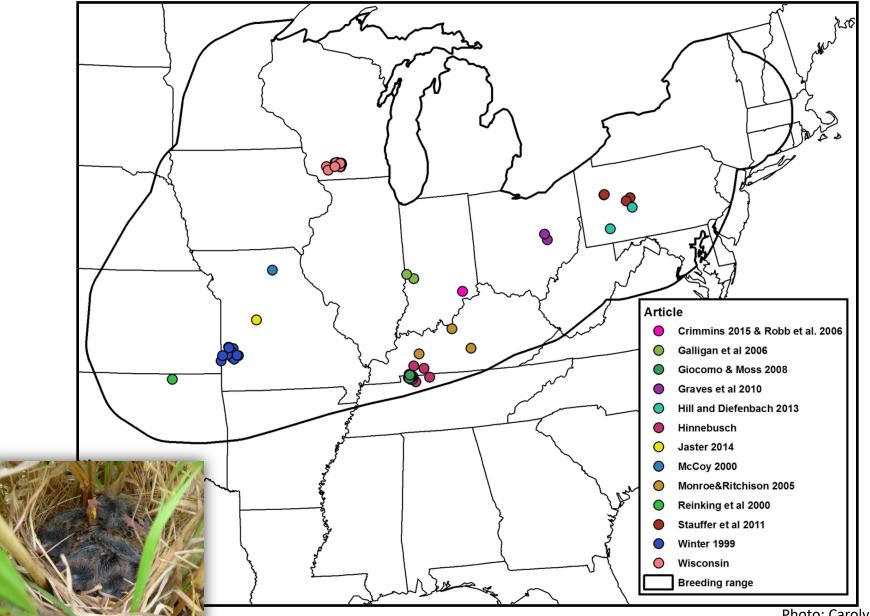
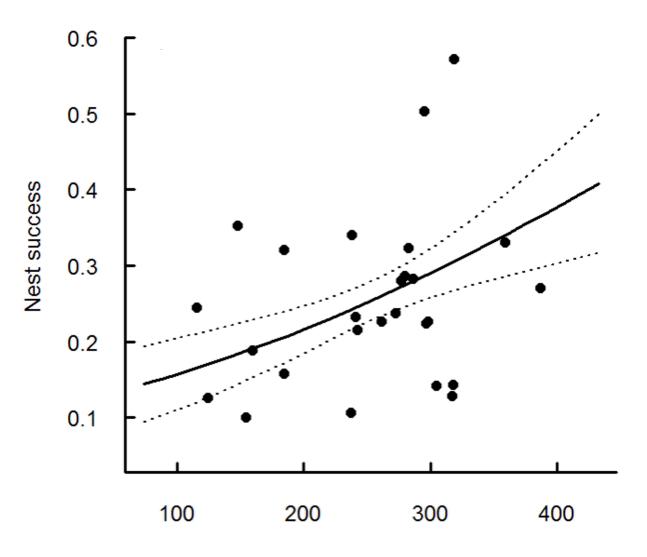


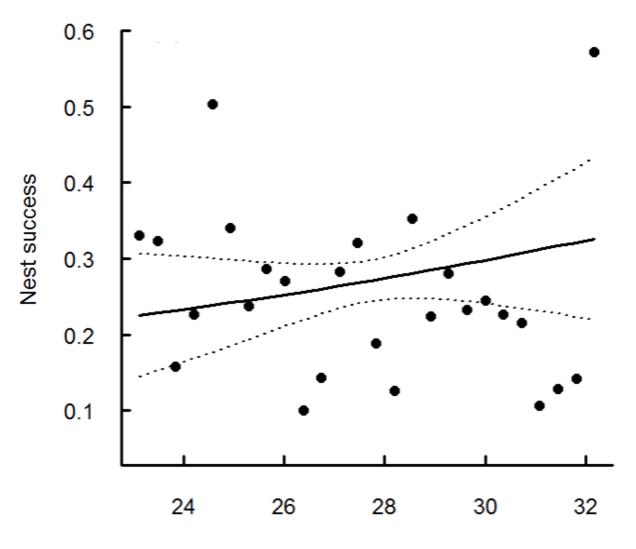
Photo: Carolyn Schmitz

Sensitivity - Precipitation



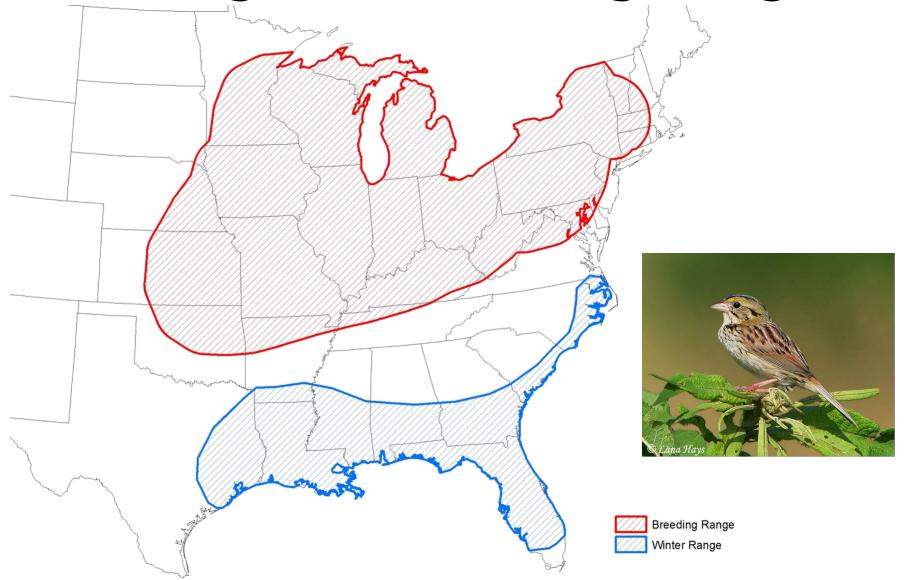
Breeding season precipitation (mm)

Sensitivity - Temperature

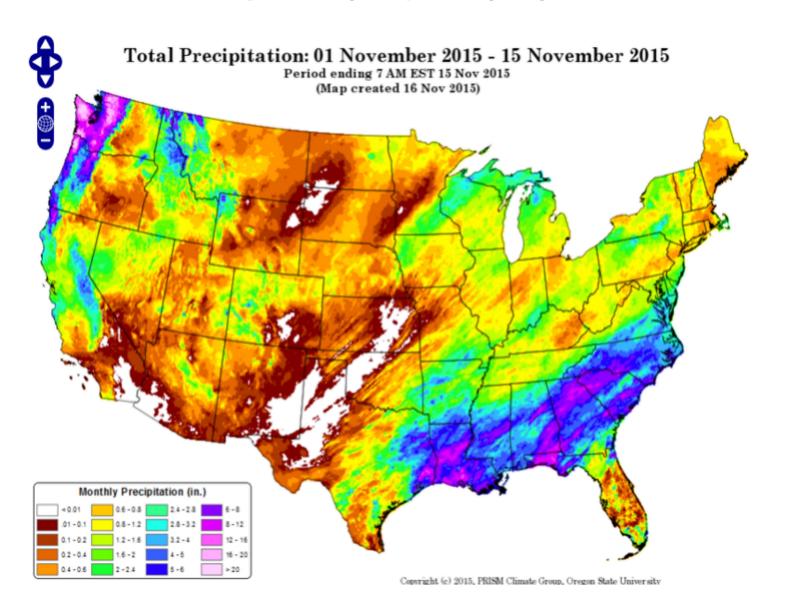


Breeding season avg max temp (°C)

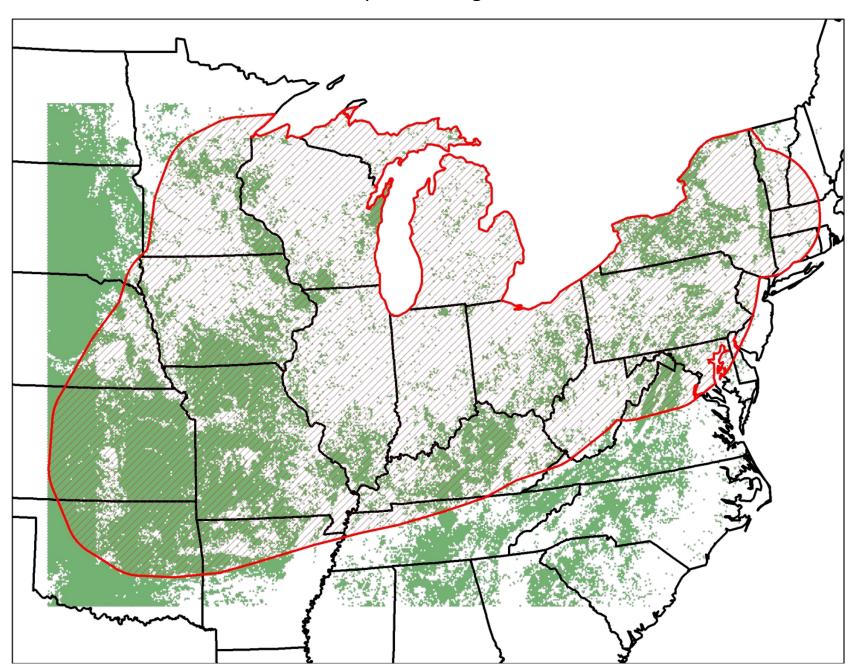
Breeding and Wintering Range

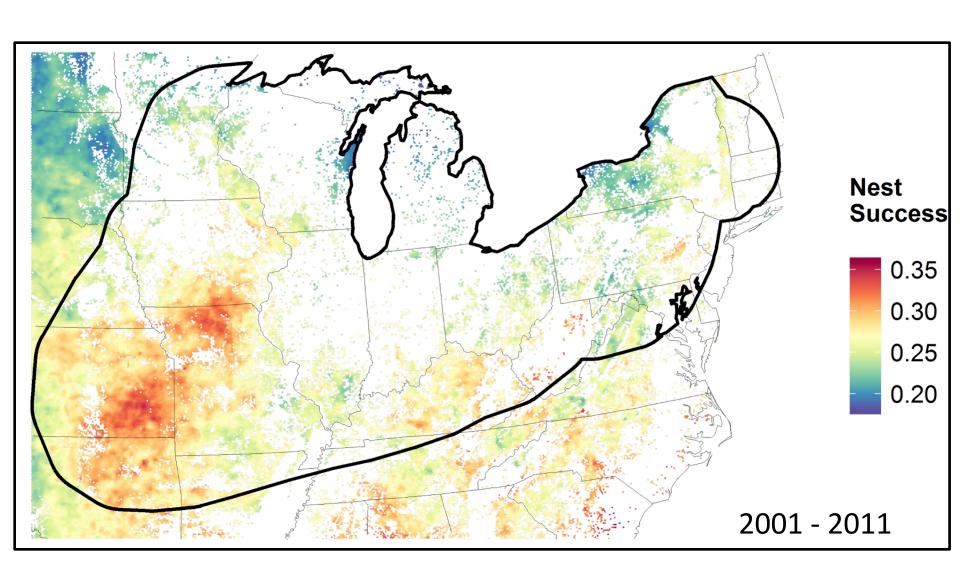


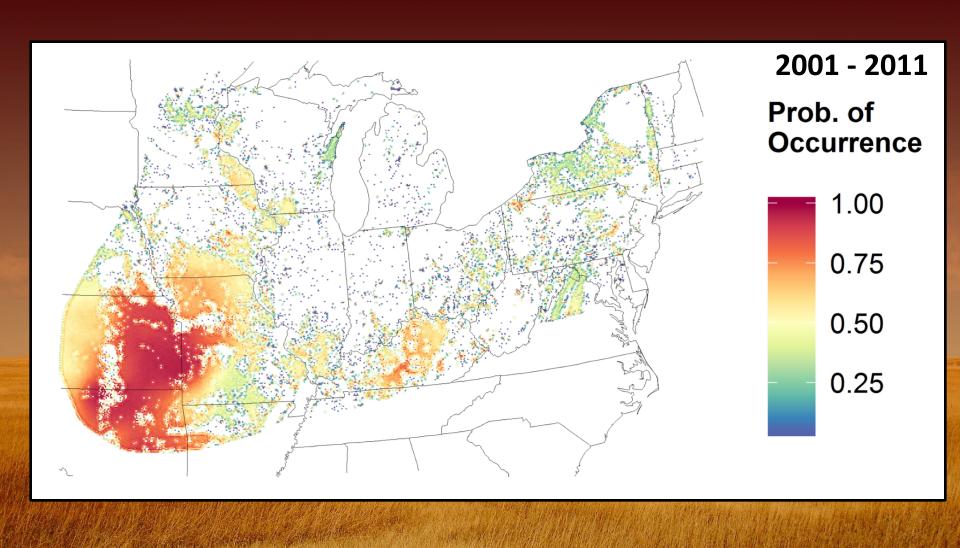
Climate Data



100 ha patches of grassland

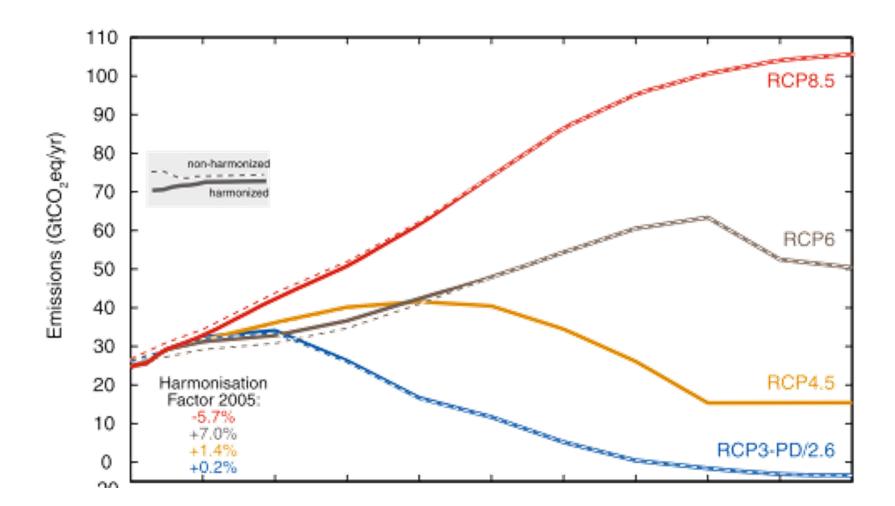




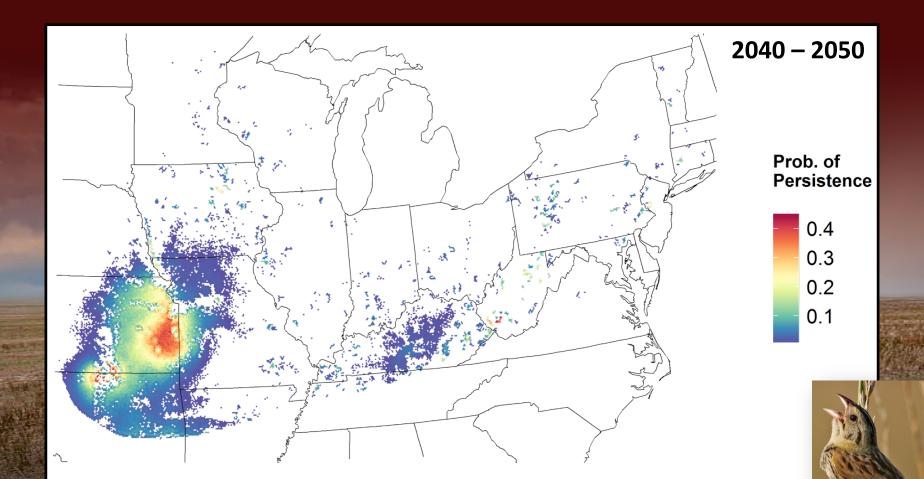


Future Climate Projections

Breeding season precipitation and temperature RCP 4.5 and 8.5



Climate Change Vulnerability



Future scenario: Probability a population (20 birds) is present

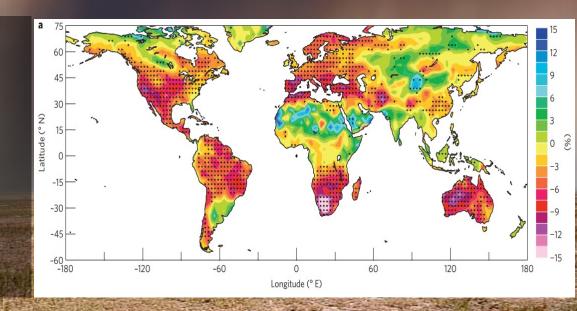
Sensitivity

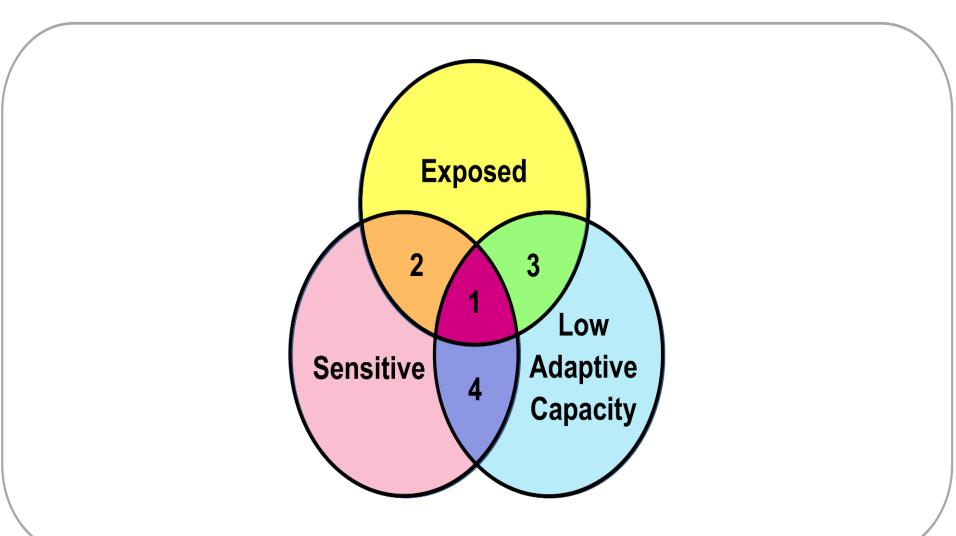


Exposure

Widespread droughts predicted to increase

Precipitation changes highly variable, difficult to predict

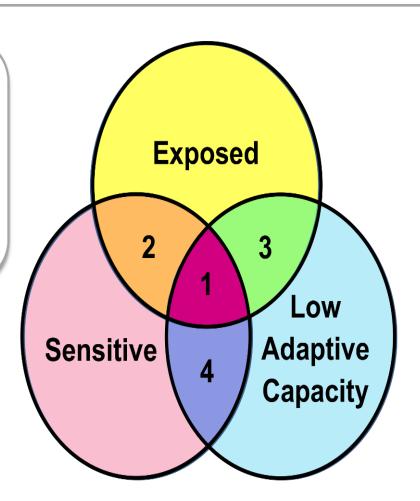




1. Highly Vulnerable

At greatest risk

- Specific research needed
- Interventions generally needed



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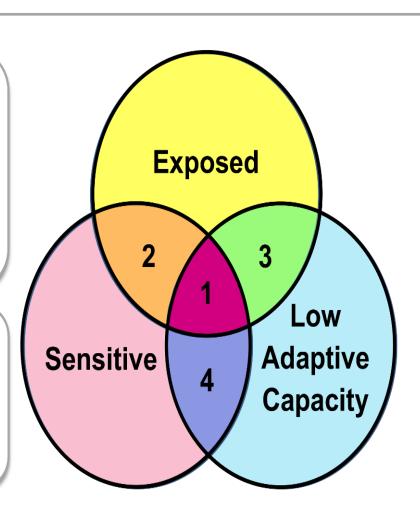
At greatest risk

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2. Potential Adapters

May be at risk

 Monitor and support adaptive responses



1. Highly Vulnerable

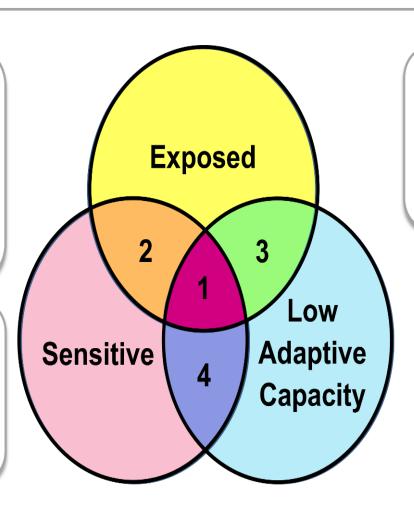
At greatest risk

- Specific research needed
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2. Potential Adapters

May be at risk

 Monitor and support adaptive responses



3. Potential Persisters

May not be at risk

Monitor population trends

1. Highly Vulnerable

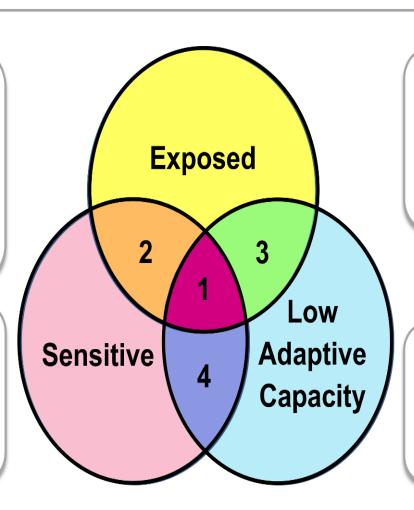
At greatest risk

- Specific research needed
- Interventions generally needed

2. Potential Adapters

May be at risk

 Monitor and support adaptive responses



3. Potential Persisters

May not be at risk

Monitor population trends

4. High Latent Risk

Not currently at risk

Monitor environment

Vulnerability Exercise

Working in small groups
Identify a grassland species of
conservation concern

Sensitivity:

Dispersal (DISP)

Disturbance (DIST)

Resources (DIET)

Shifts (RANGE)

Exposure (your specific region):

Drought?

Maximum temperature?

