# Effects of extreme climate events on avian demographics

P. Heglund, A. Pidgeon, R. Akcakaya, T. Albright, A. Allstadt, B. Bateman, C. Flather, J. Gorzo, W. Thogmartin, S. Vavrus, A. Venegas, and Volker C. Radeloff

US Fish and Wildlife Service, USGS, US Forest Service

University of Wisconsin-Madison,

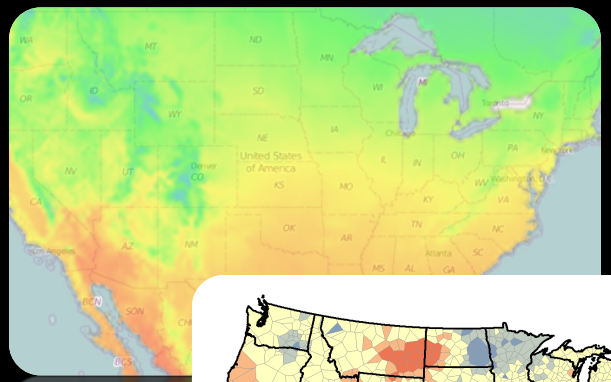
et al.,

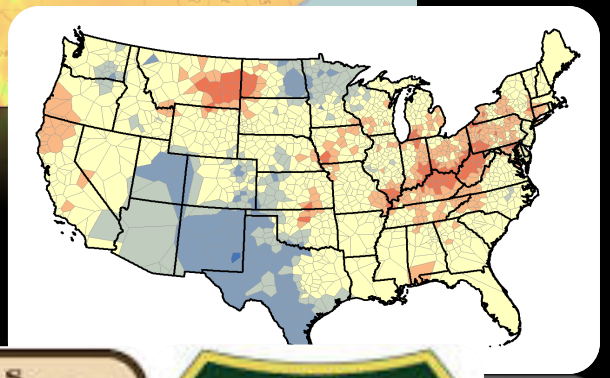
# Outline

I. Extreme climate events

II. Bird population response

III. Conservation implications



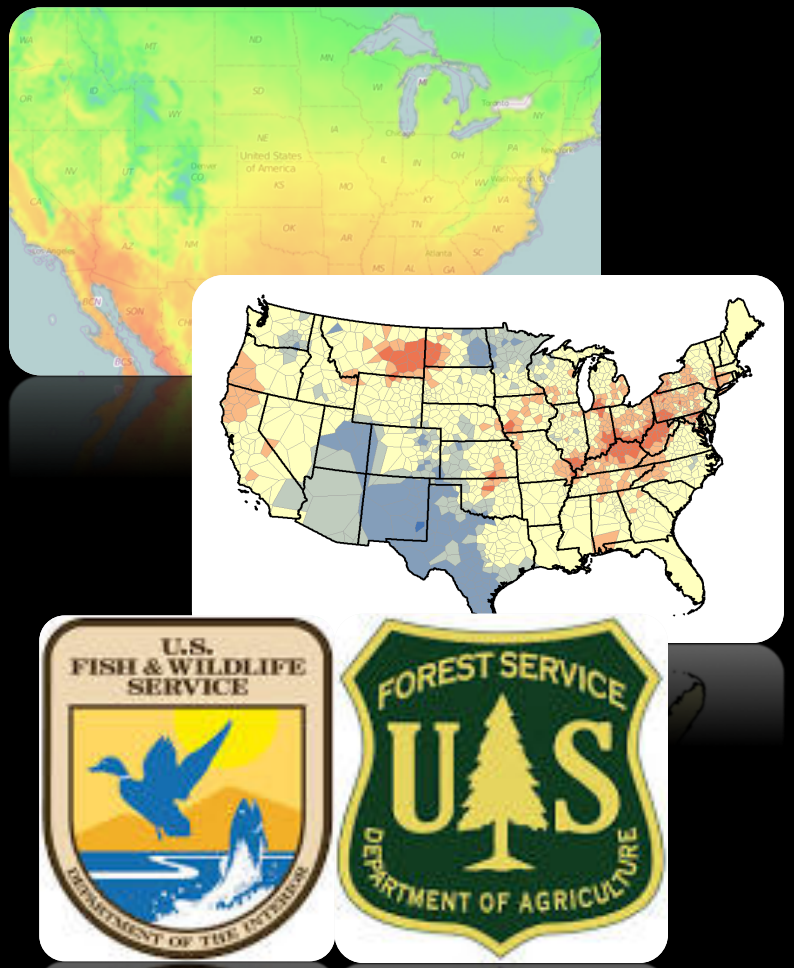


# Outline

I. Extreme climate events

II. Bird population response

III. Conservation implications

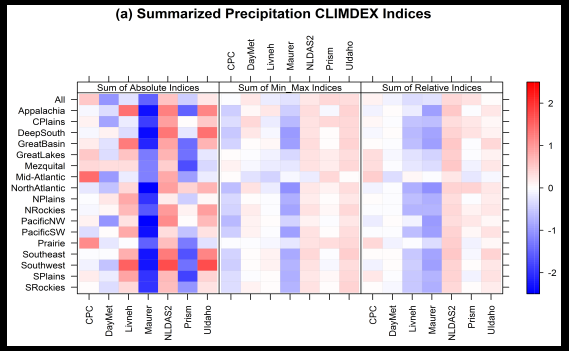


# Extreme climate events

| Index | Weather Station Data | | Climate Model Data BCCA, 19 CMIP5 GCMs, RCP45 and RCP 85 | |
|---|---|---|---|---|
| | Daymet 1980 – 2014 1-km, daily | Maurer 1949 – 2010 12-km, daily | BCCA, 1950 - 2000 12-km, daily | BCCA, 2006 - 2100 12-km, daily |
| BIOCLIM, annually | Done | Done | Done | Done |
| CLIMDEX ETCCDI | Done | Done | Done | Done |
| Monthly and seasonal summaries | Done | Done | Done | Done |
| SPI | Done | Done | Done | Done |
| STI | Done | Done | Done | Done |
| SPEI | Not planned | Done | Done | Done |
| False springs | Not planned | Done | Done | Done |

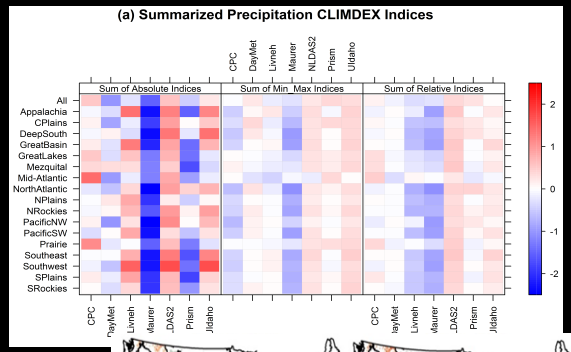
# Extreme climate events

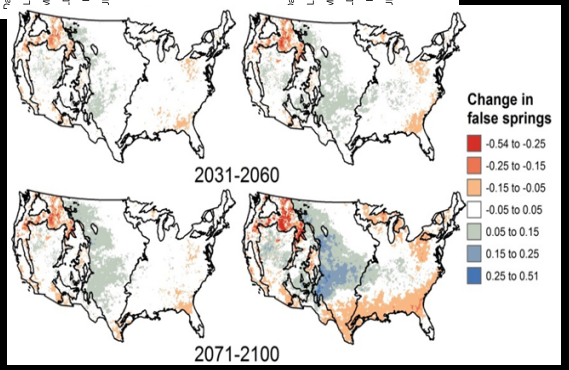
- Behnke, et al. Evaluation of downscaled, gridded climate data … ***Ecological Applications****, in press.*



# Extreme climate events

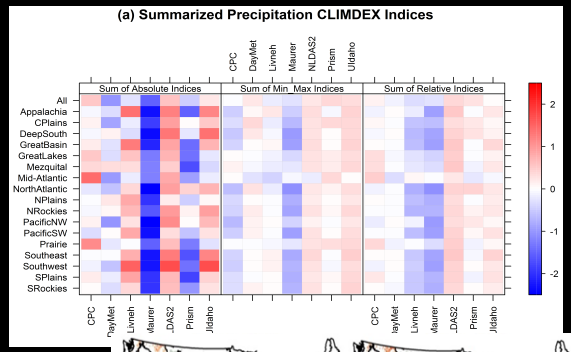
- Behnke, et al. Evaluation of downscaled, gridded climate data … ***Ecological Applications**, in press.*
- Allstadt, et al. 2015. False springs (…) during the 21st century. ***ERL**, 10(10): 104008.*

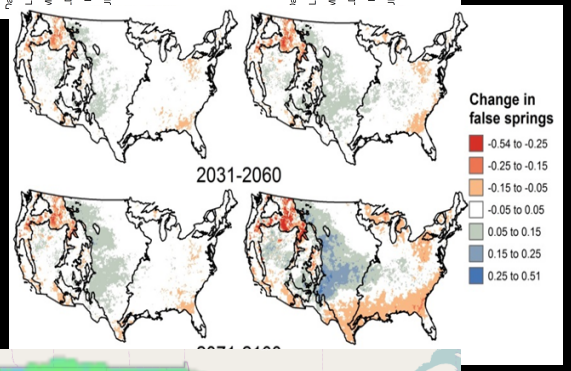


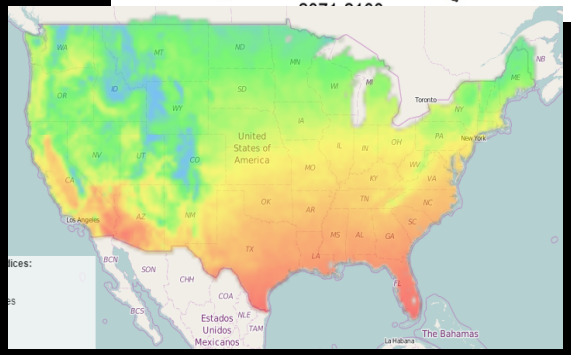



# Extreme climate events

- Behnke, et al. Evaluation of downscaled, gridded climate data … ***Ecological Applications**, in press.*
- Allstadt, et al. 2015. False springs (…) during the 21st century. ***ERL**, 10(10): 104008.*
- Allstadt, et al. ***Ecology**, data paper, in review.*



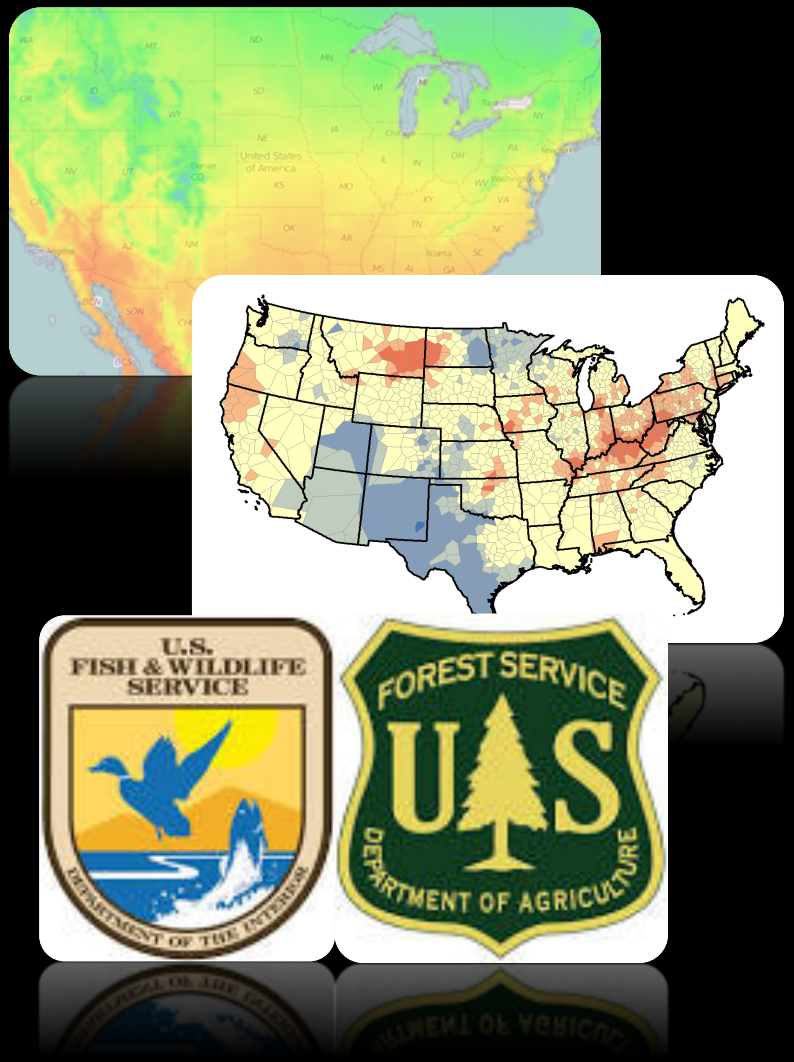



# Outline

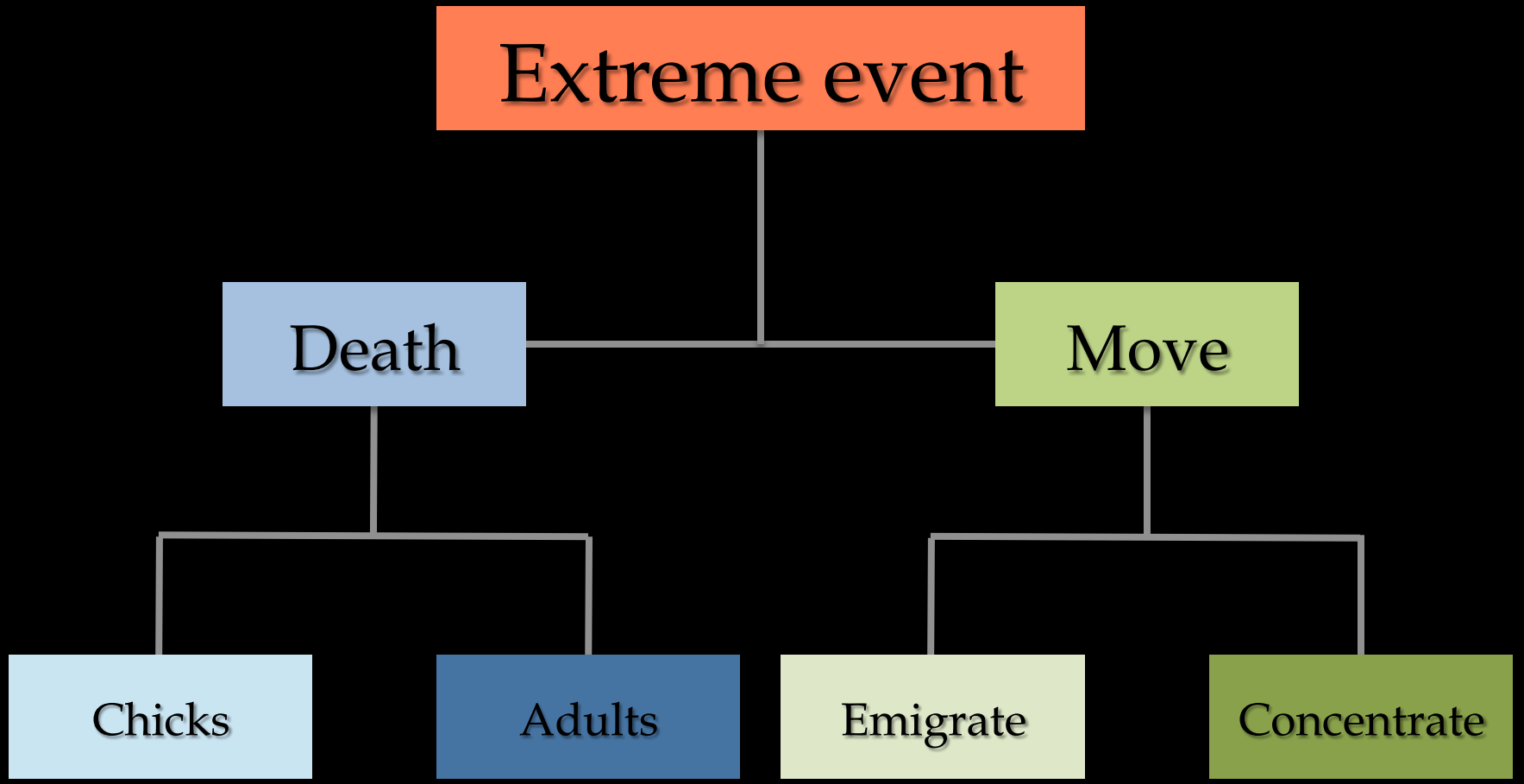
I. Extreme climate events

II. Bird population response

III. Conservation implications

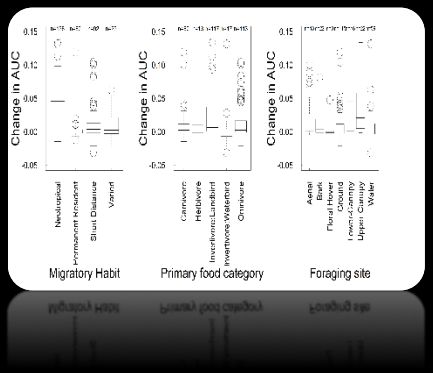


# Bird population responses



# Bird population responses

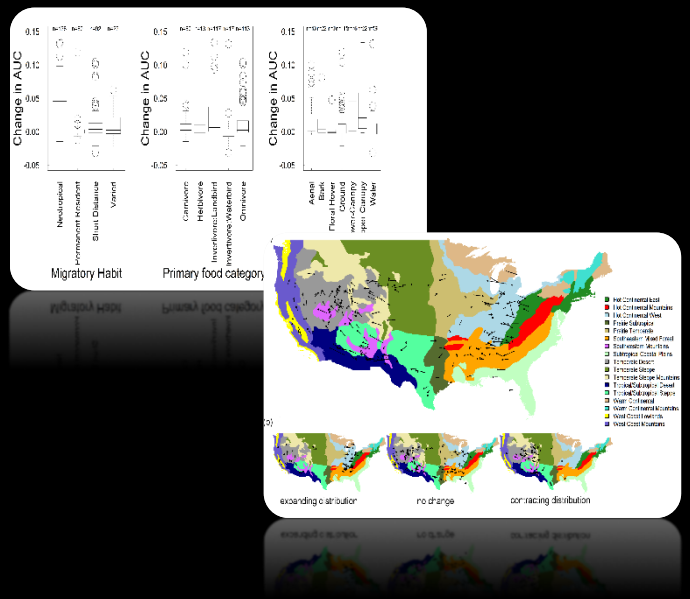
- Bateman, et al., Long- vs. short-term climate variability and birds. ***EcoApps,*** *in press.*



# Bird population responses

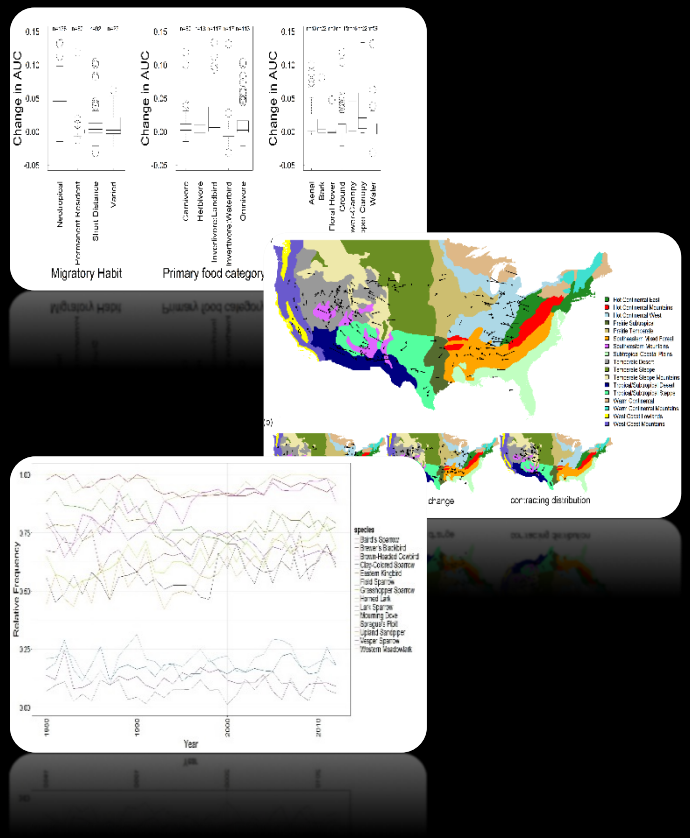
- Bateman, et al., Long- vs. short-term climate variability and birds. ***EcoApps**, in press.*

- Bateman, et al., 2016. Past climate change versus bird distributions. ***GCB**, 22: 1130-44.*



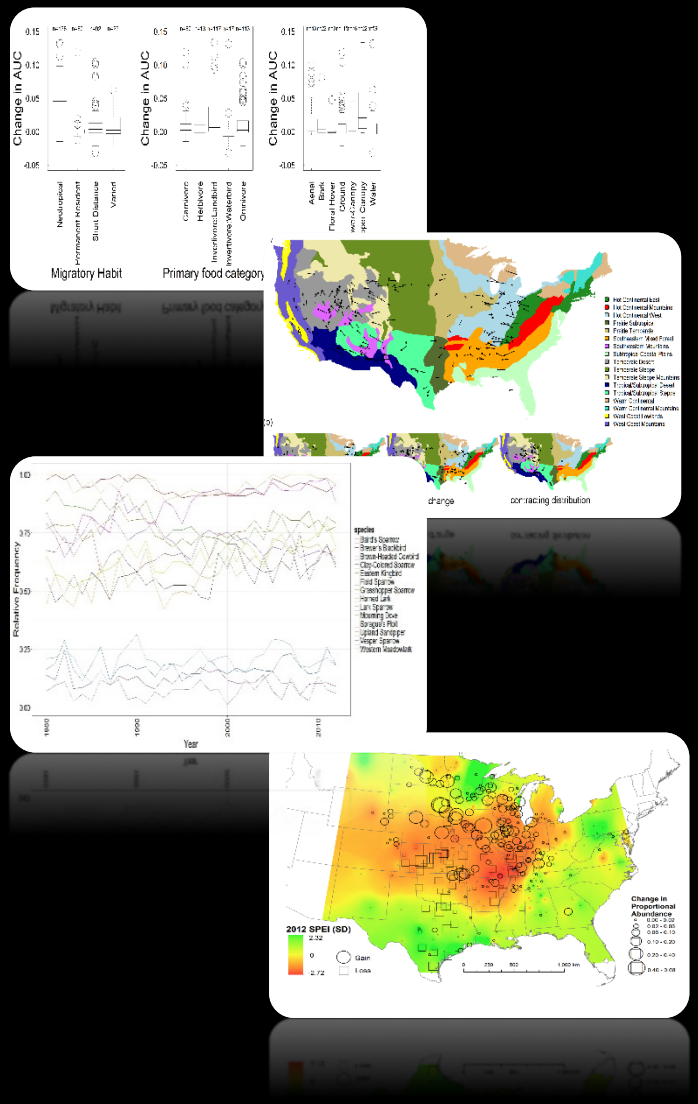
# Bird population responses

- Bateman, et al., Long- vs. short-term climate variability and birds. ***EcoApps**, in press.*
- Bateman, et al., 2016. Past climate change versus bird distributions. ***GCB**, 22: 1130-44.*
- Gorzo, et al., Grassland bird response to weather. ***Condor**, in press.*

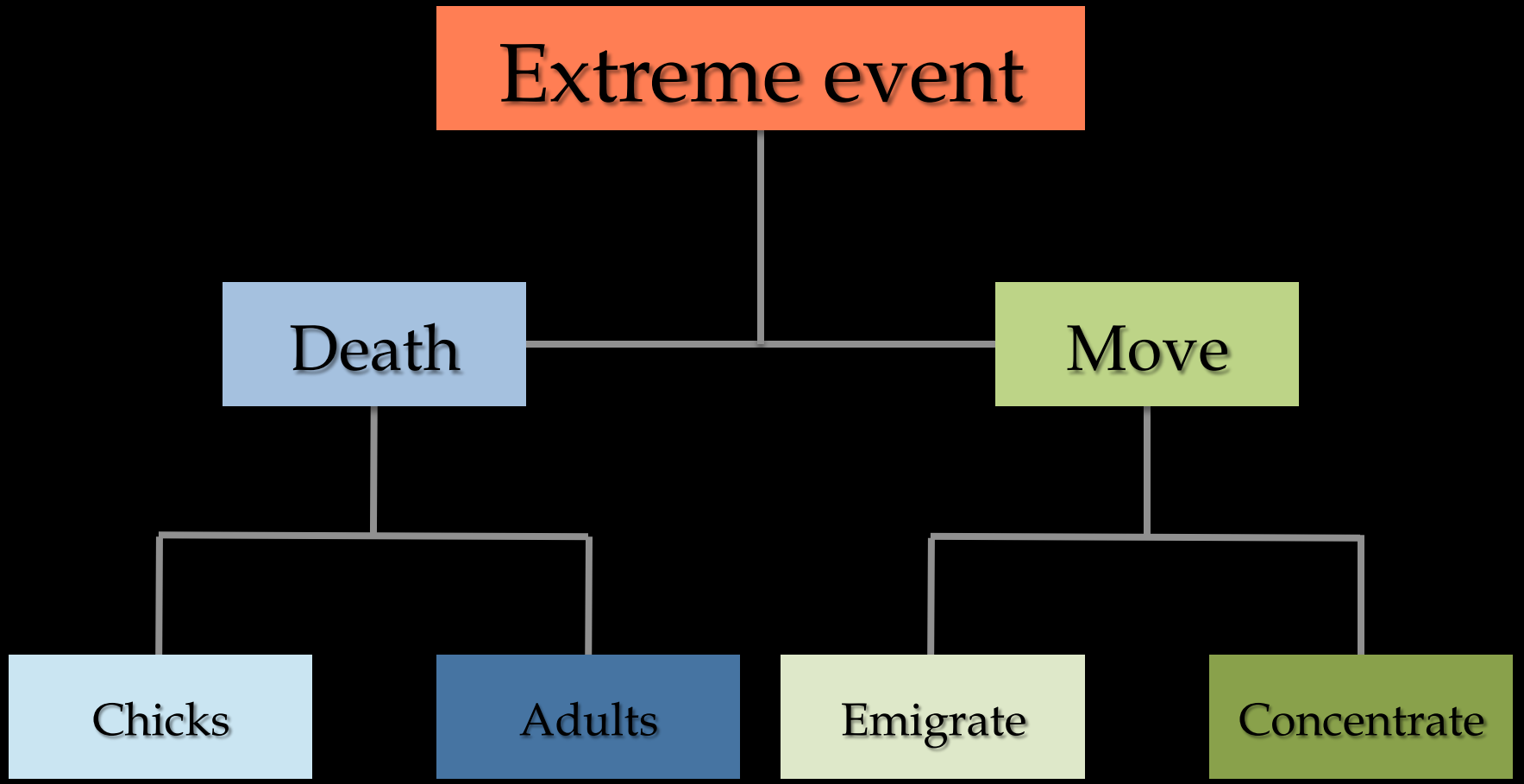


# Bird population responses

- Bateman, et al., Long- vs. short-term climate variability and birds. ***EcoApps**, in press.*
- Bateman, et al., 2016. Past climate change versus bird distributions. ***GCB**, 22: 1130-44.*
- Gorzo, et al., Grassland bird response to weather. ***Condor**, in press.*
- Bateman, et al. 2015. Range edges and irruptive species during extreme weather. ***Lands. Ecol.**, 30: 1095-1110.*



# Bird population responses



# Bird population responses

- Bayesian Hierarchical Modeling with INLA

$$log(\lambda_{i,t}) = R_i + \omega_{i,t} + I_{i,t}\eta + \delta_{i,t} + (1\lambda_{i,t-1} + N(0,\sigma_i^2)) + V + \rho\sum_{i \neq j} w_{i,j}(v_i - V)$$

- Modeling a 20-year climate extreme versus the median year

# Bird population responses

| Species | Local SPEI | Range-wide SPEI | Dec-May La Niña | Dec-May El Niño |
|---|---|---|---|---|
| Northern Cardinal | 1.1 | 1.1 | -0.2 | 0.2 |
| Ruffed Grouse | -0.5 | -6.8 | 5.2 | -2.9 |
| Rose-Breasted Grosbeak | 1.5 | 1.2 | -1.3 | 0.9 |
| Indigo Bunting | -0.1 | 0.3 | 0 | 0 |
| Grasshopper Sparrow | -4.3 | 5.3 | 0.6 | -0.6 |
| Lark Sparrow | 3.3 | 6.2 | 2.5 | -2.6 |
| Dickcissel | -15.9 | 23.6 | 5.7 | -4.1 |

# Bird population responses

| Species | Local SPEI | Range-wide SPEI | Dec-May La Niña | Dec-May El Niño |
|---|---|---|---|---|
| Northern Cardinal | 1.1 | 1.1 | -0.2 | 0.2 |
| Ruffed Grouse | -0.5 | -6.8 | 5.2 | -2.9 |
| Rose-Breasted Grosbeak | 1.5 | 1.2 | -1.3 | 0.9 |
| Indigo Bunting | -0.1 | 0.3 | 0 | 0 |
| Grasshopper Sparrow | -4.3 | 5.3 | 0.6 | -0.6 |
| Lark Sparrow | 3.3 | 6.2 | 2.5 | -2.6 |
| Dickcissel | -15.9 | 23.6 | 5.7 | -4.1 |

# Bird population responses

| Species | Local SPEI | Range-wide SPEI | Dec-May La Niña | Dec-May El Niño |
|---|---|---|---|---|
| Northern Cardinal | 1.1 | 1.1 | -0.2 | 0.2 |
| Ruffed Grouse | -0.5 | -6.8 | 5.2 | -2.9 |
| Rose-Breasted Grosbeak | 1.5 | 1.2 | -1.3 | 0.9 |
| Indigo Bunting | -0.1 | 0.3 | 0 | 0 |
| Grasshopper Sparrow | -4.3 | 5.3 | 0.6 | -0.6 |
| Lark Sparrow | 3.3 | 6.2 | 2.5 | -2.6 |
| Dickcissel | -15.9 | 23.6 | 5.7 | -4.1 |

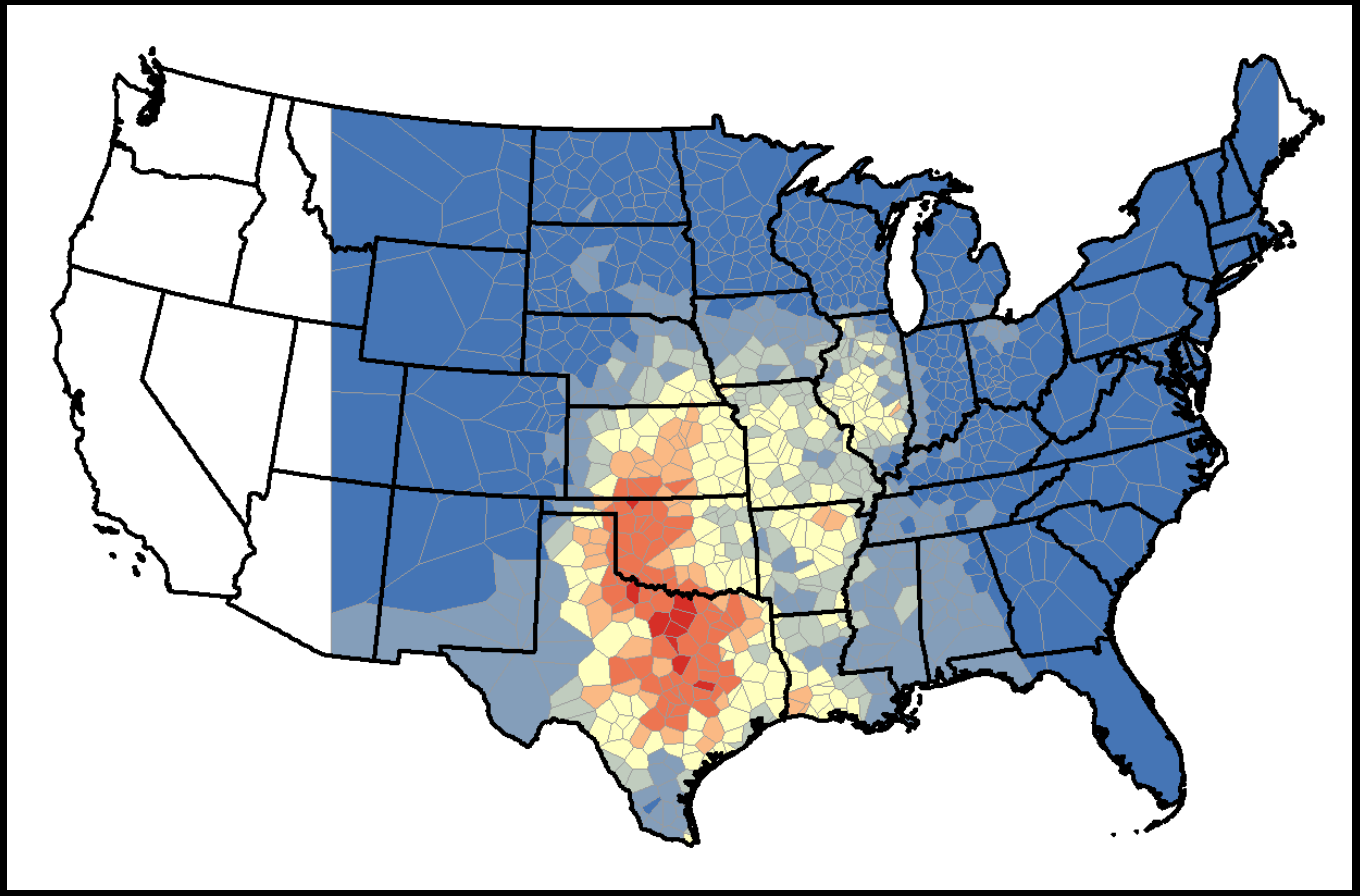
# Bird population responses

- Bayesian Hierarchical Modeling with INLA

$$log(\lambda_{i,t}) = R_i + \omega_{i,t} + I_{i,t}\eta + \delta_{i,t} + (1\lambda_{i,t-1} + N(0,\sigma_i^2)) + V + \rho\sum_{i \neq j} w_{i,j}(v_i - V)$$

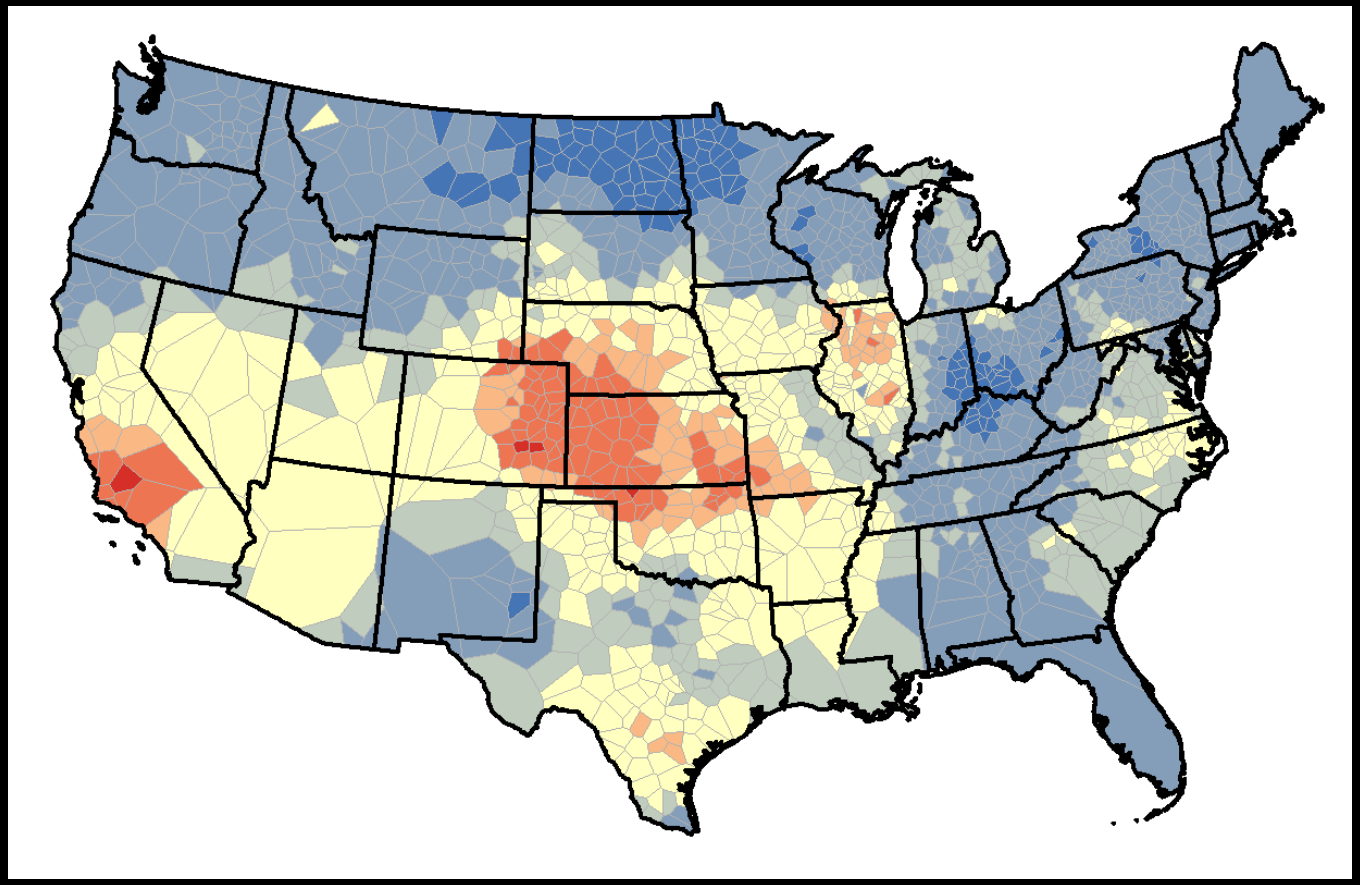
- Modeling a 20-year climate extreme versus the median year

# Bird population responses



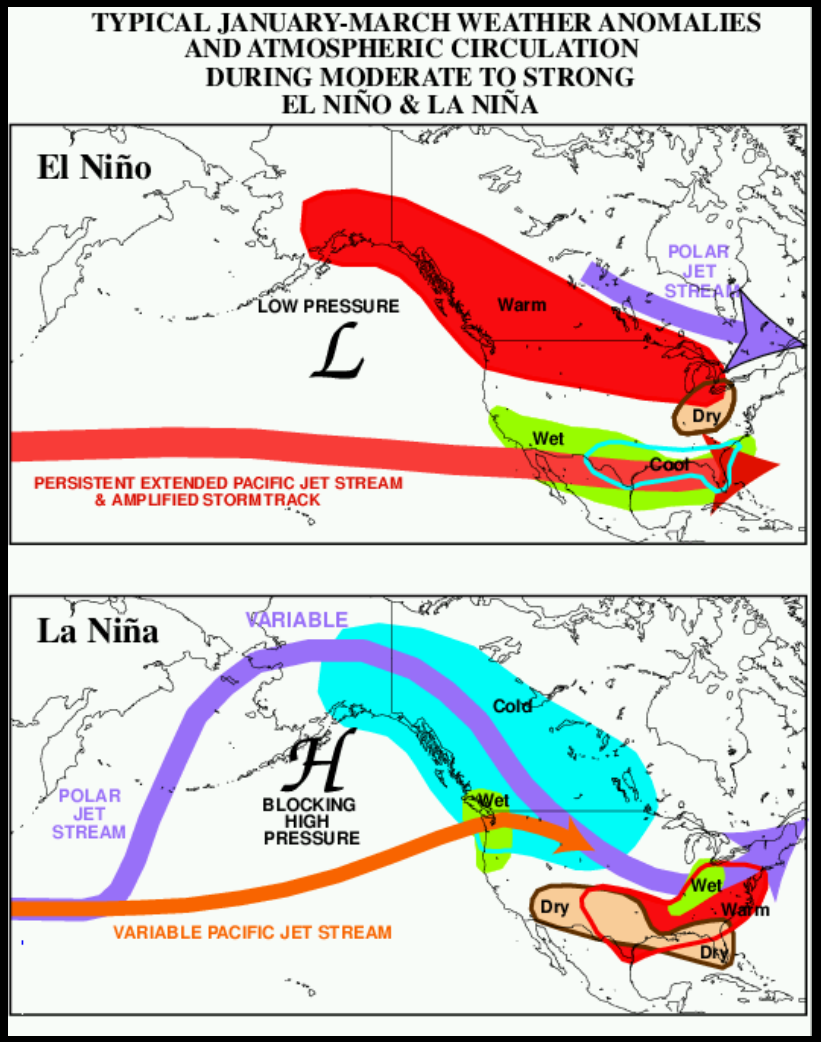
Dickcissel Rangewide SPEI

# Bird population responses

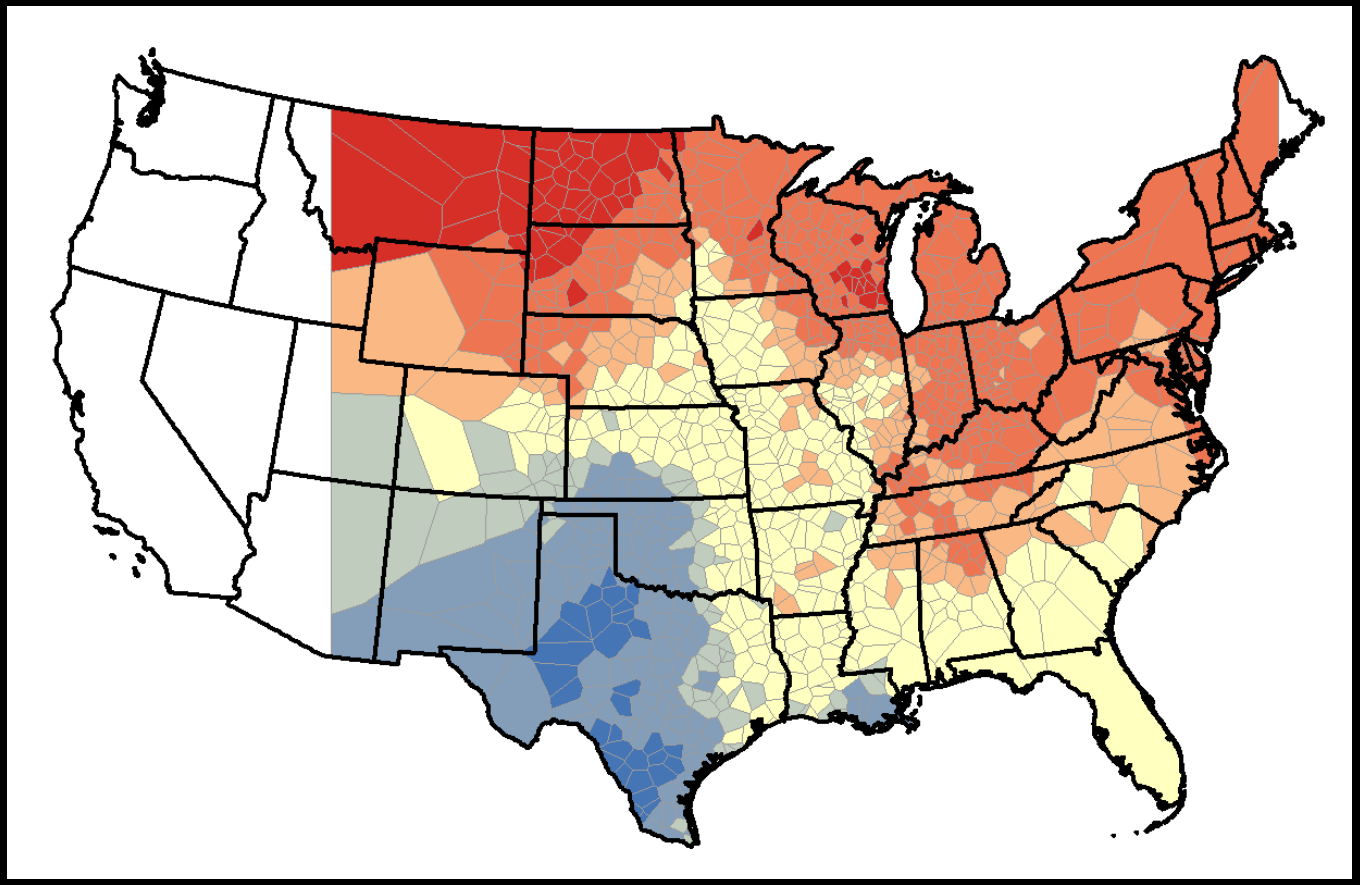


Grasshopper Sparrow RW-SPEI

# Bird population responses

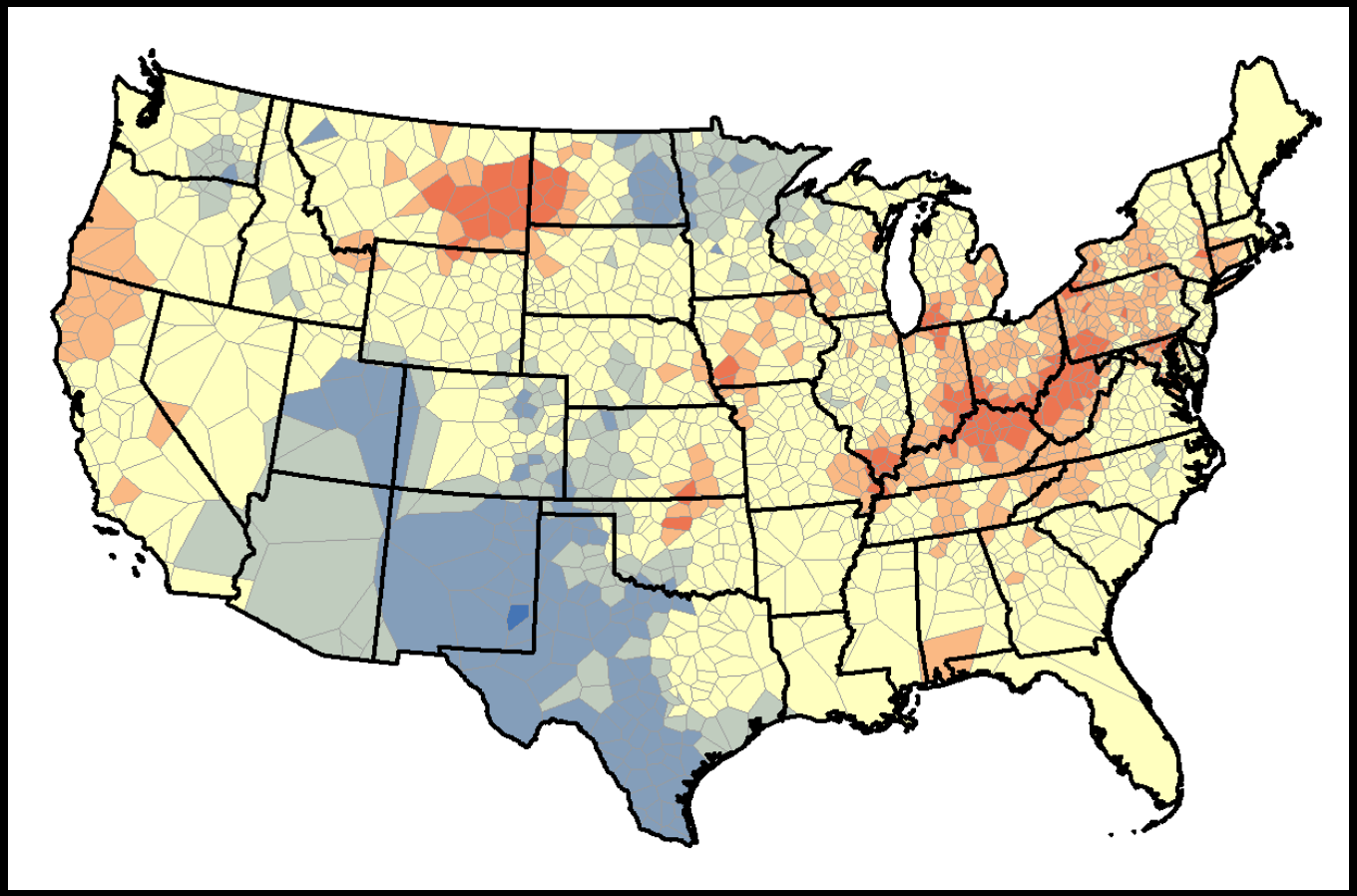


# Bird population responses



Dickcissel ENSO

# Bird population responses



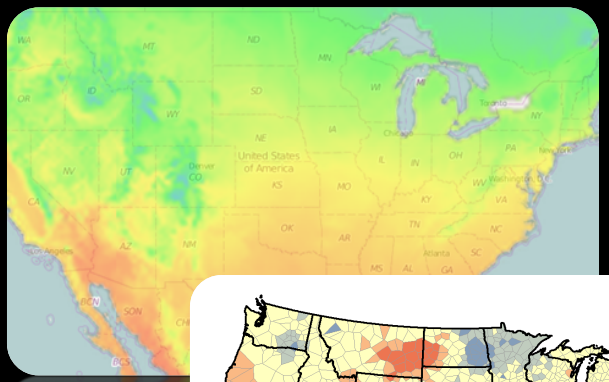
Grasshopper Sparrow ENSO

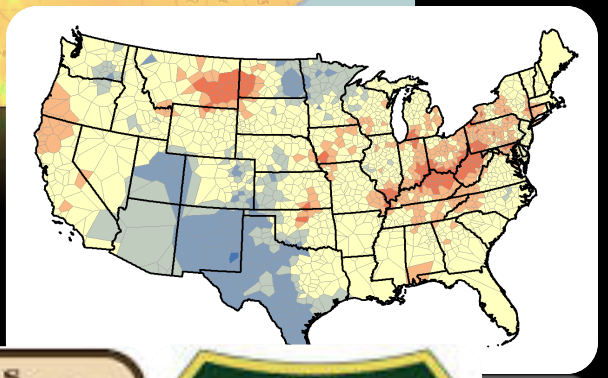
# Outline

I. Extreme climate events

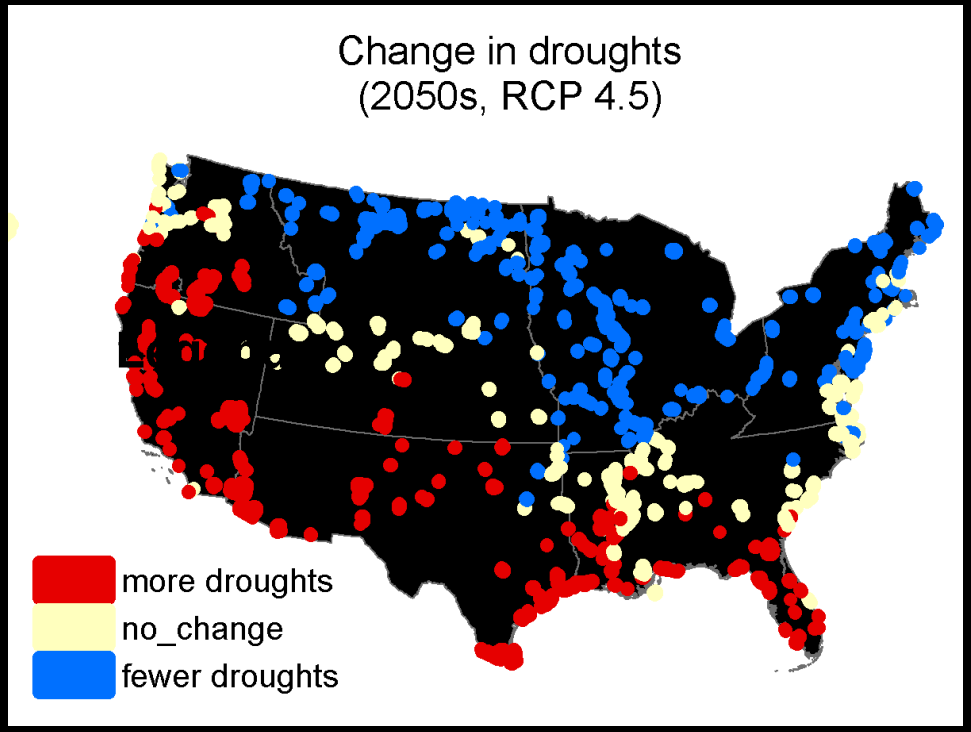
II. Bird population response

III. Conservation implications



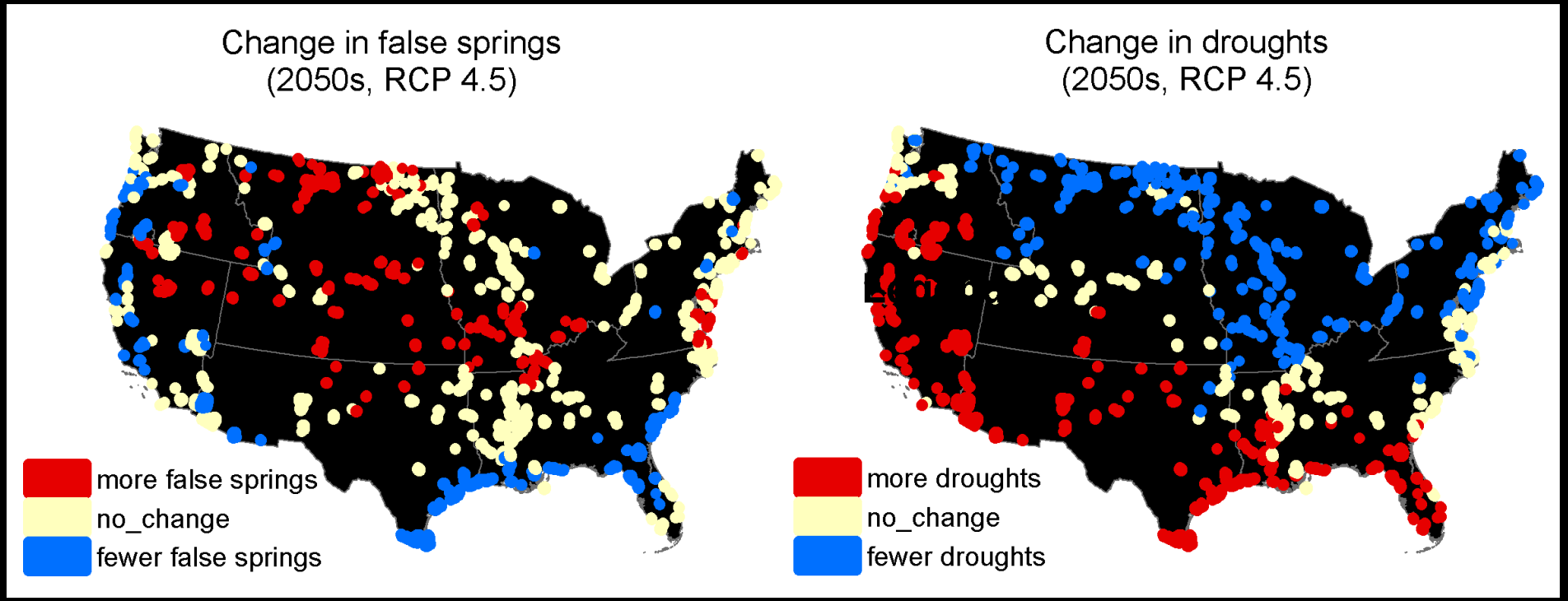


# Conservation implications



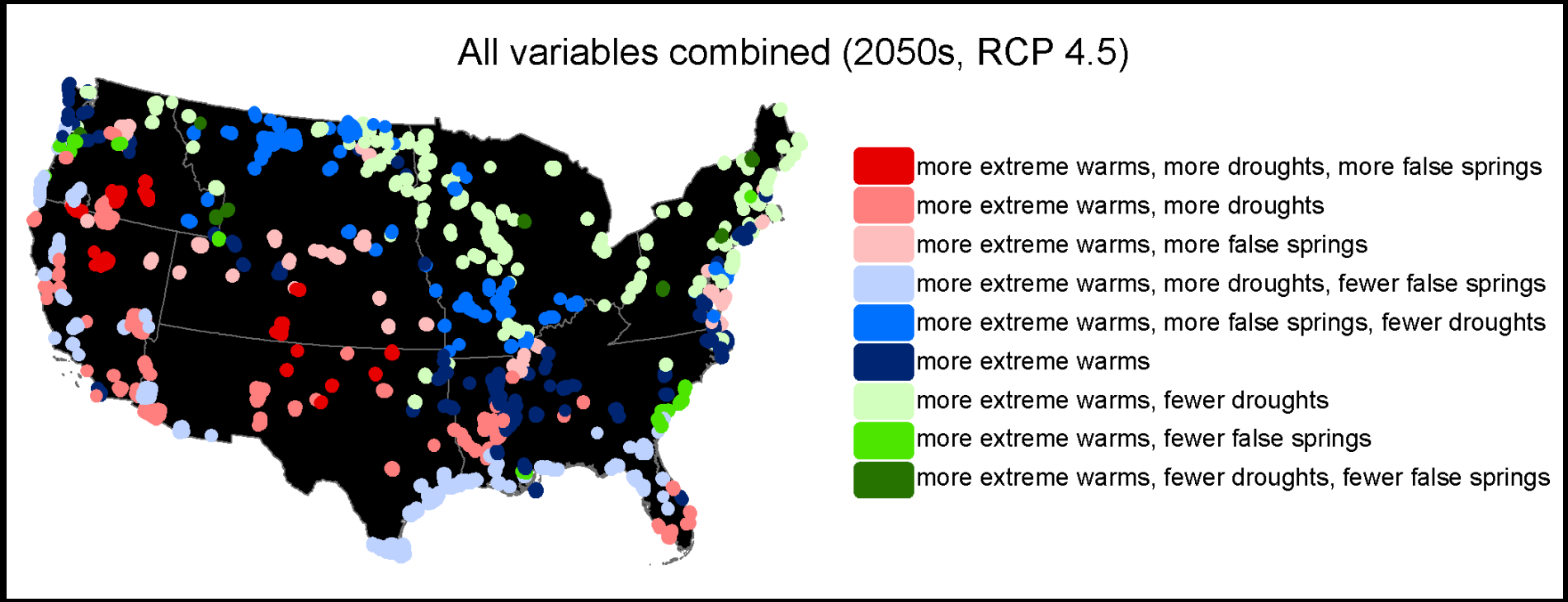

Martinuzzi et al., *in press,*
Biological Conservation

# Conservation implications



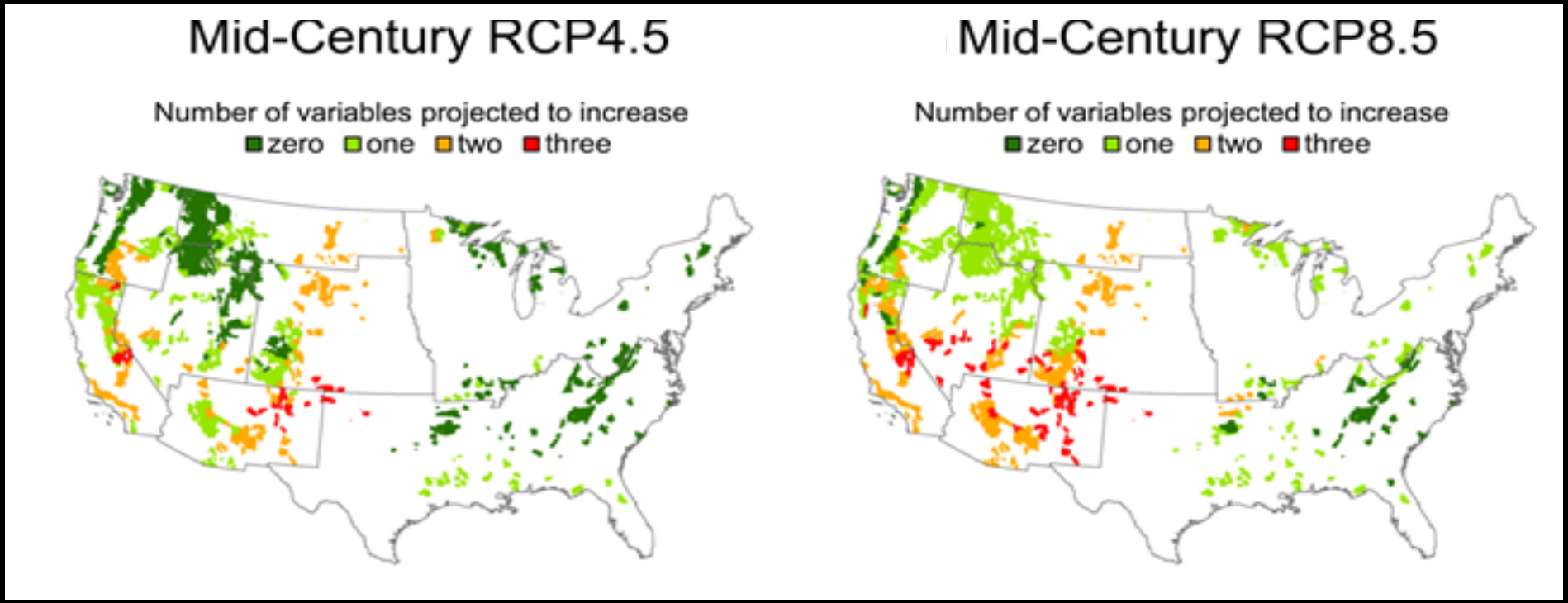

Martinuzzi et al., *in press*, Biological Conservation

# Conservation implications




Martinuzzi et al., *in press,* Biological Conservation

# Conservation implications

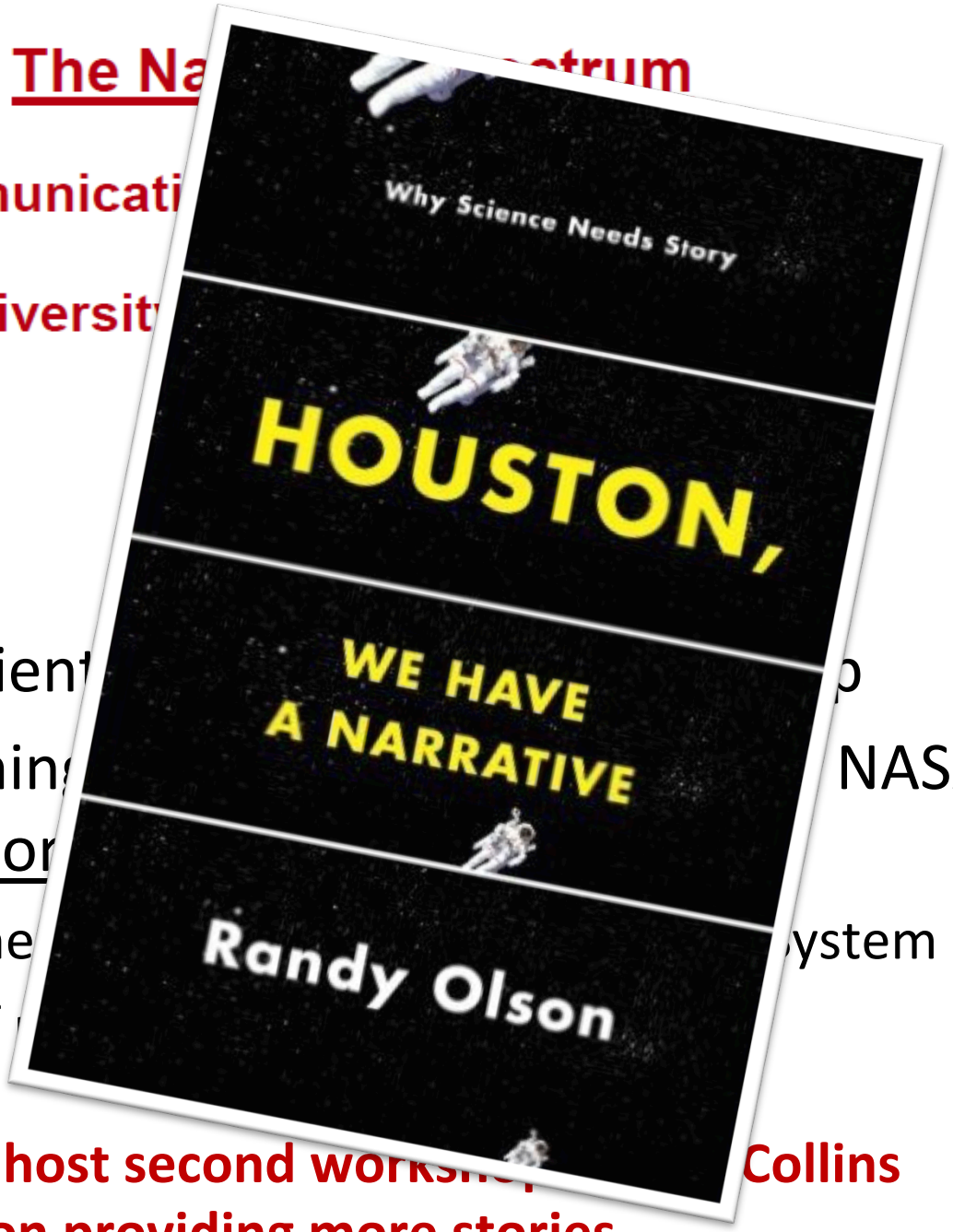



Martinuzzi et al., *in prep*,

The Na trum

Communicati

Universit




- 25 managers and scient p
- USFWS is using trainin NASA-funded work into shor
  - How extreme weathe ystem
  - External Affairs staff

**This spurred USFWS to host second worksh Collins with focus on providing more stories**

## The Narrative Spectrum

**Communications Training for Scientists**

**University of Wisconsin- Madison**

**With**

**Dr. Randy Olson**

- 25 managers and scientists attended the workshop
- USFWS is using training to translate results of our NASA-funded work into short stories
  - How extreme weather may affect N Wildlife Refuge System
  - External Affairs staff using stories in public outreach

**This spurred USFWS to host second workshop in Fort Collins with focus on providing more stories**

U.S. Fish & Wildlife Service
Conservation in a Changing Climate
Office of External Affairs
Enter Search Term(s):
Search
Home
Climate 101
Wildlife Impacts
FWS Response
Get Involved
About Us
FWS RESPONSE
Archived Updates
December 2015
September 2015
July 2015
May 2015
March 2015
January 2015
October 2014
September 2014
July 2014
May 2014
March 2014
Climate Change Update
SIGN UP HERE
....share success stories, identify key resources, .....
Stories to be used by Service biologists as they prepare to draft 10 year strategic plan for monitoring:
– effects of management actions
– how climate projections are unfolding
– how habitats and wildlife are responding
Shared Stories and Priorities
Interagency Group Seeks Nominations for Climate Adaptation Leadership Award

**Thinking Like Mountains - A Practitioner's Symposium for Continental Conservation Under Climate Change**

Date: Monday, July 18, 2016
Time: 8:00 AM - 10:00 AM
Location: Exhibit Hall B

**Session Organizer 1:**
Anna M Pidgeon

**Affiliation 1:**
SILVIS Lab, Department of Forest and Wildlife Ecology, UW-Madison

**Session Organizer 2:**
Patricia Heglund

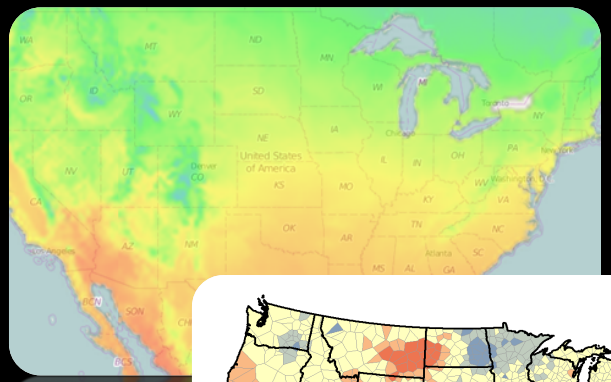
**Affiliation 2:**
United States Fish and Wildlife Service, La Crosse, Wisconsin

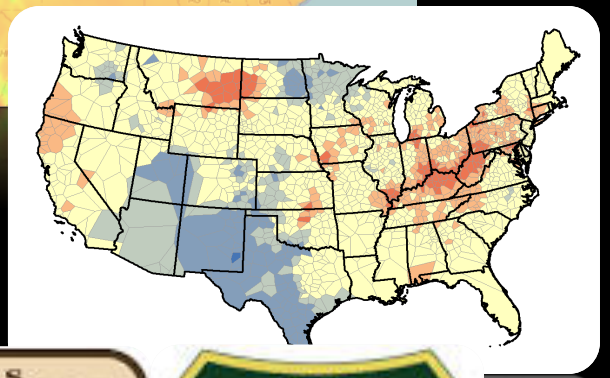
# Outline

I. Extreme climate events

II. Bird population response

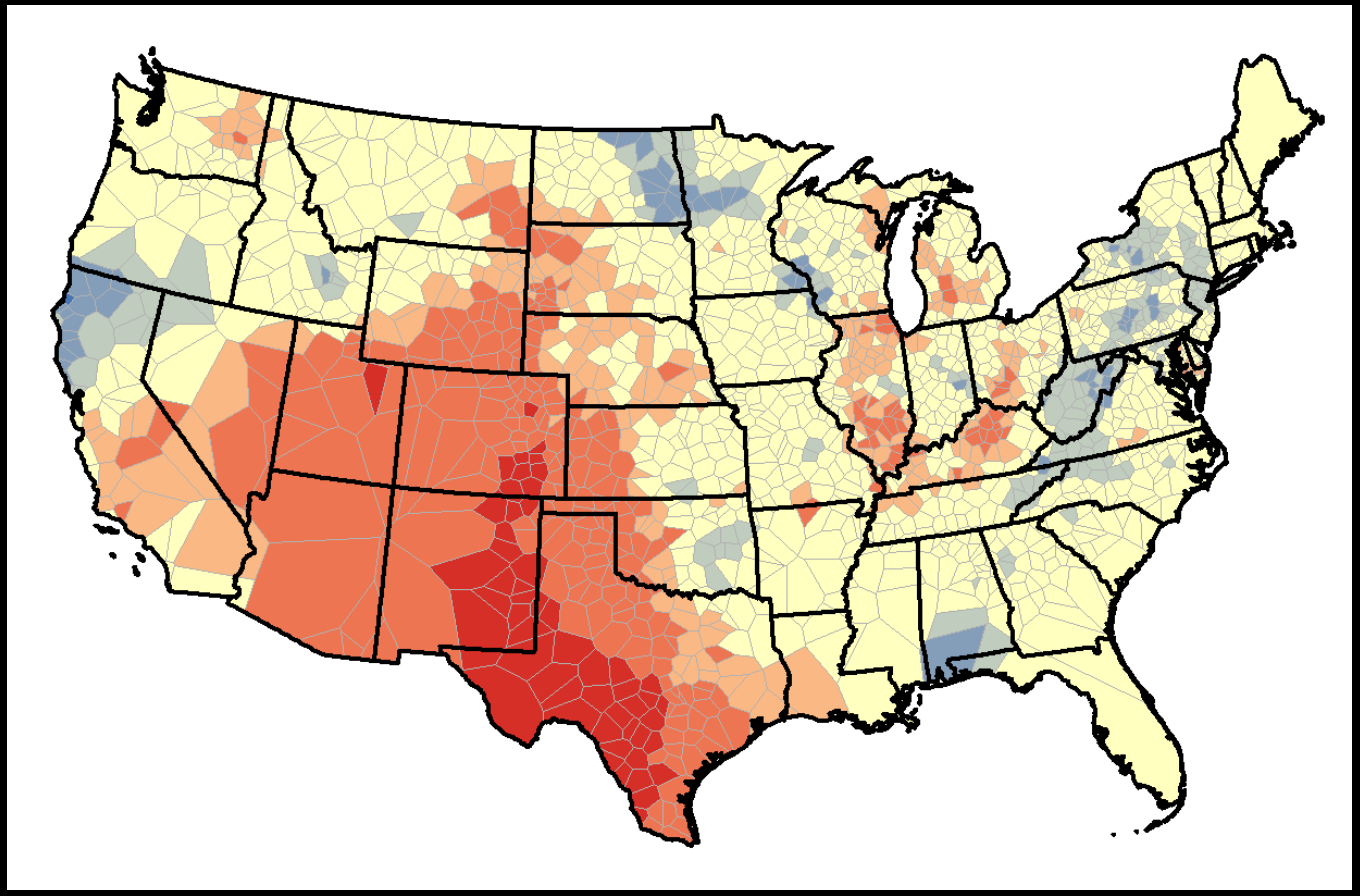
III. Conservation implications





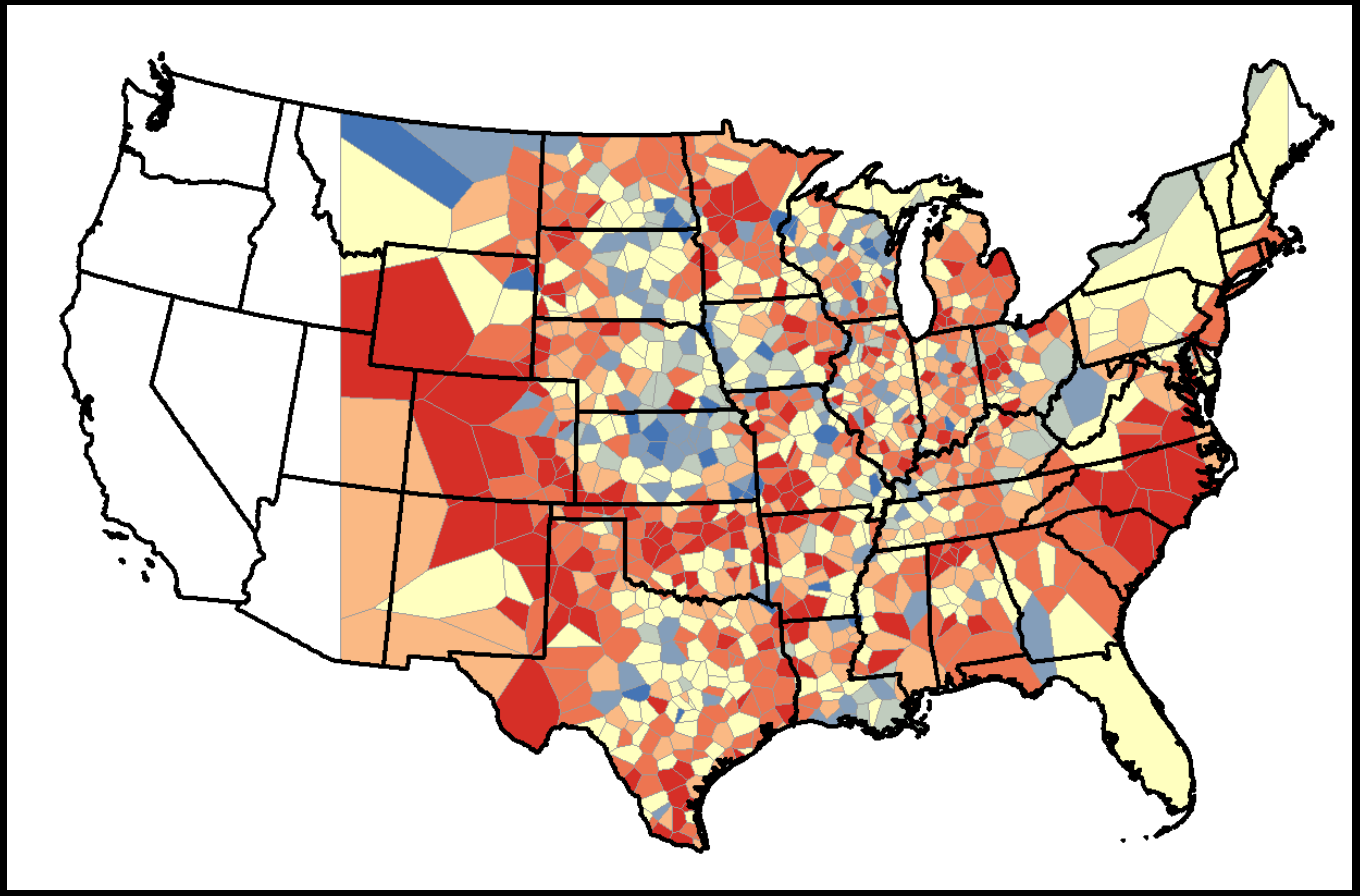
Thank you!

# Bird population responses



Grasshopper Sparrow L-SPEI

# Bird population responses



Dickcissel Local SPEI