Lesser Yellowlegs with a greater impact: identifying stopover habitats for conservation within the Prairie Pothole Region

Hannah Vincelette

Photo credit: Derek Otway

Tringa Flavipes

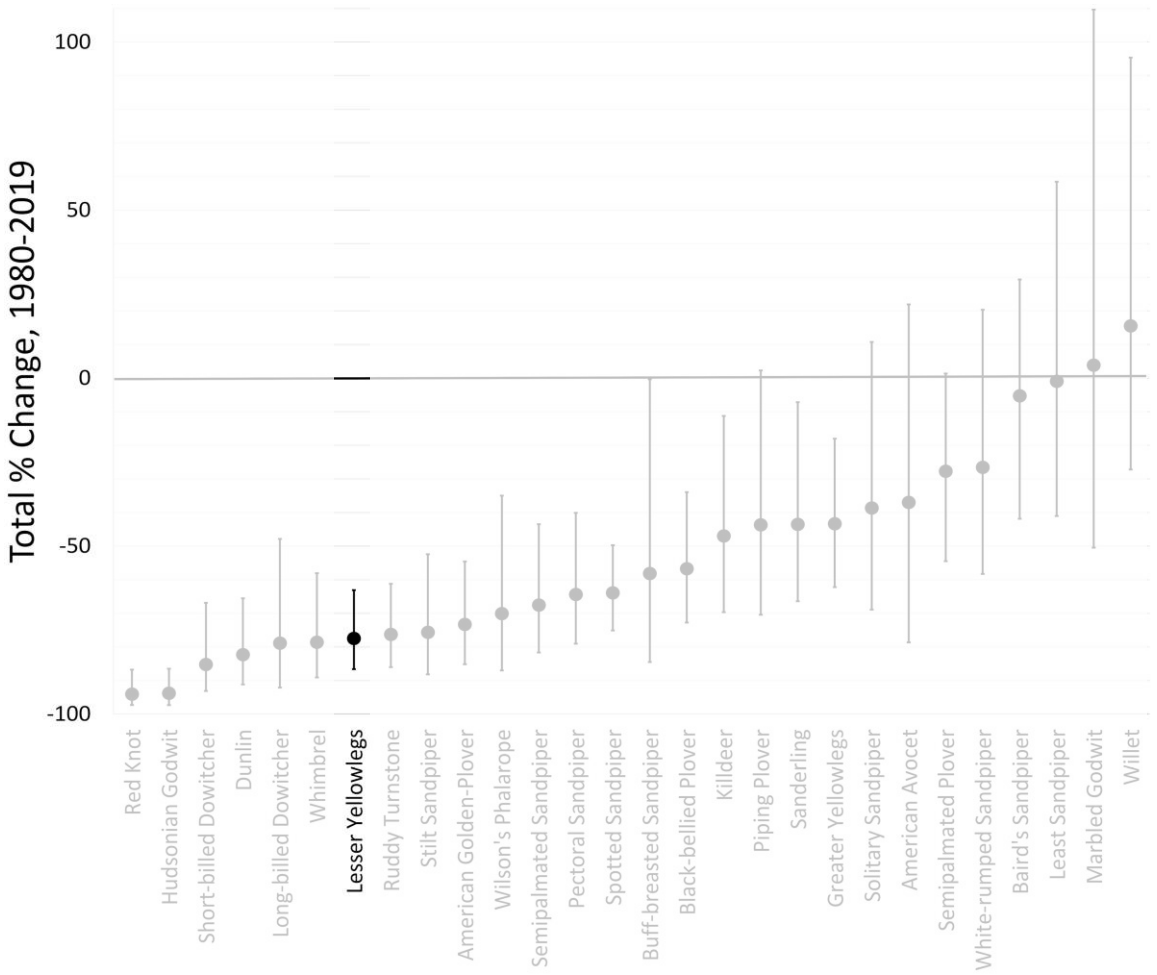
Photo credit: USFWS Mountain-Prairie

Seth Beaudreault (Toolik Field Station), XC838118.
Accessible at www.xeno-canto.org/838118.

Lesser Yellowlegs are declining

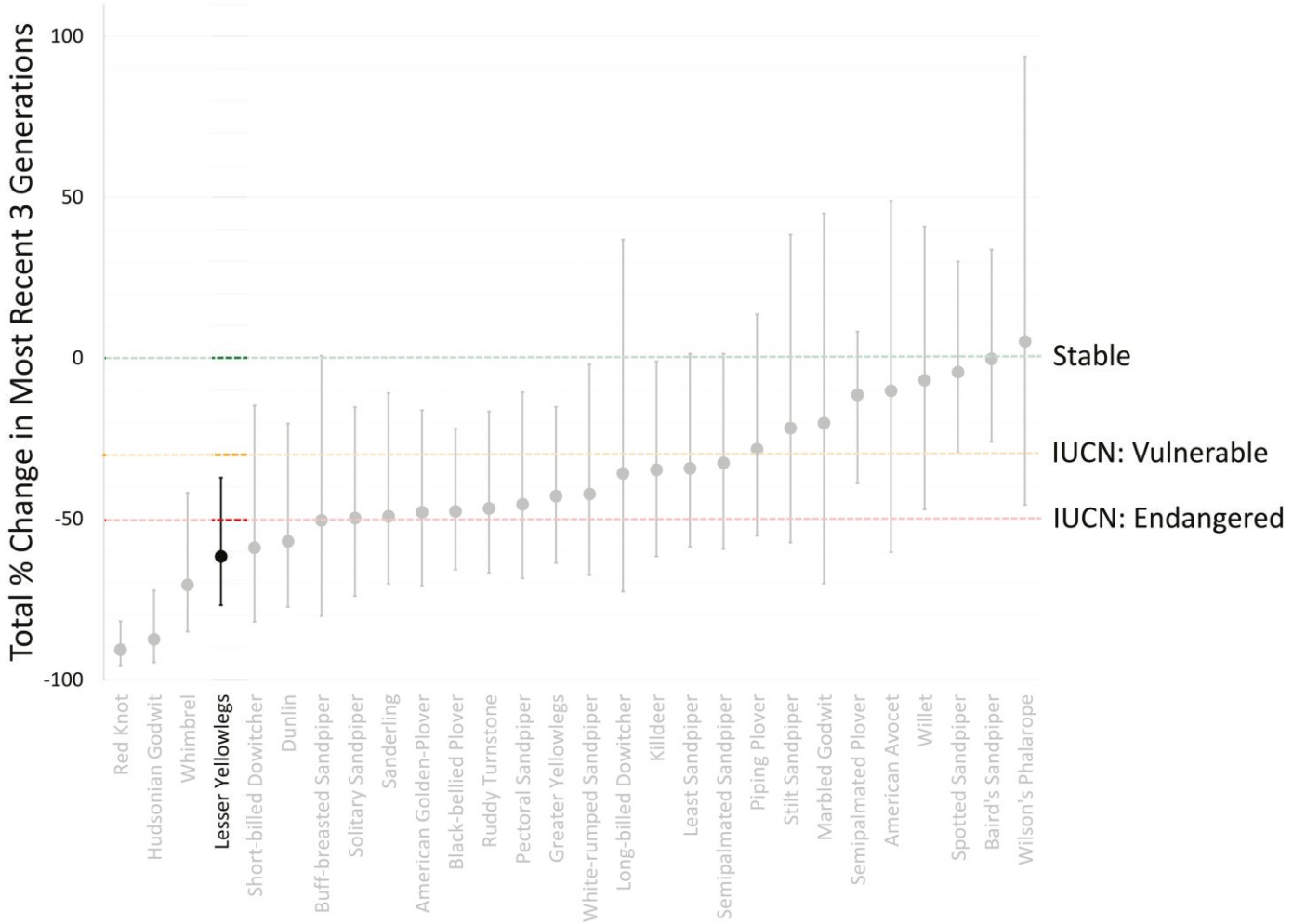
Handel and Sauer 2017

Lesser Yellowlegs are declining



Smith et al. 2023

Lesser Yellowlegs are declining



Smith et al. 2023

eBird citizen science data

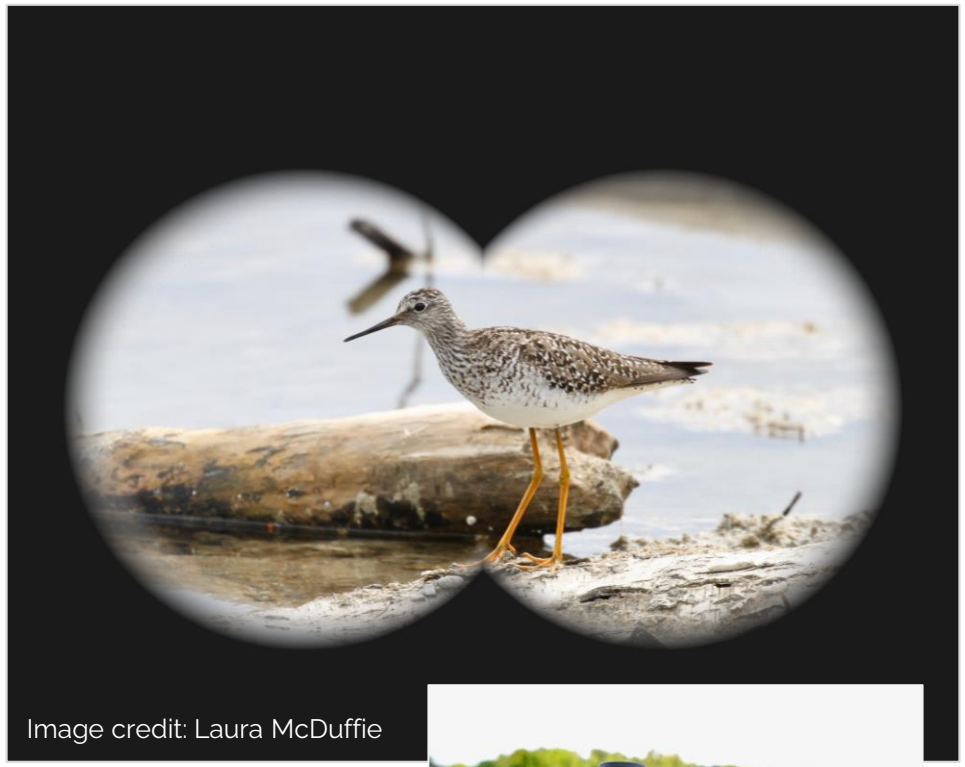


Image credit: Laura McDuffie

Image credit: Scott Einsmann

eBird Submit Explore My eBird Science About News Help Donate

eBird Alaska CHECKLIST S47536113

Sun 29 Jul 2018 11:00 AM

Tony Knowles Coastal Trail--Chester Creek to Ship Creek

Anchorage Municipality, Alaska, United States

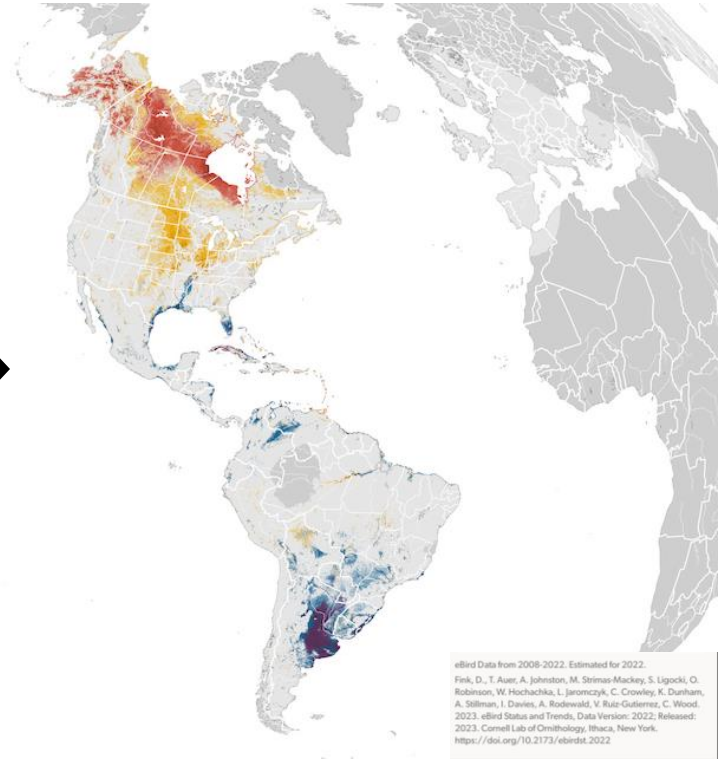
Hannah Vincelette

Traveling Complete

1 4 hr 6 mi

13 Species Observed 107 individuals

10	Cackling Goose
2	American Wigeon
10	Green-winged Teal
10	Red-necked Grebe
8	Short-billed Dowitcher
2	Wilson's Snipe
4	Lesser Yellowlegs
2	Greater Yellowlegs
30	Bonaparte's Gull
10	Short-billed Gull
8	Arctic Tern
1	Alder Flycatcher
10	Black-billed Magpie



1.45M Lesser Yellowlegs observations

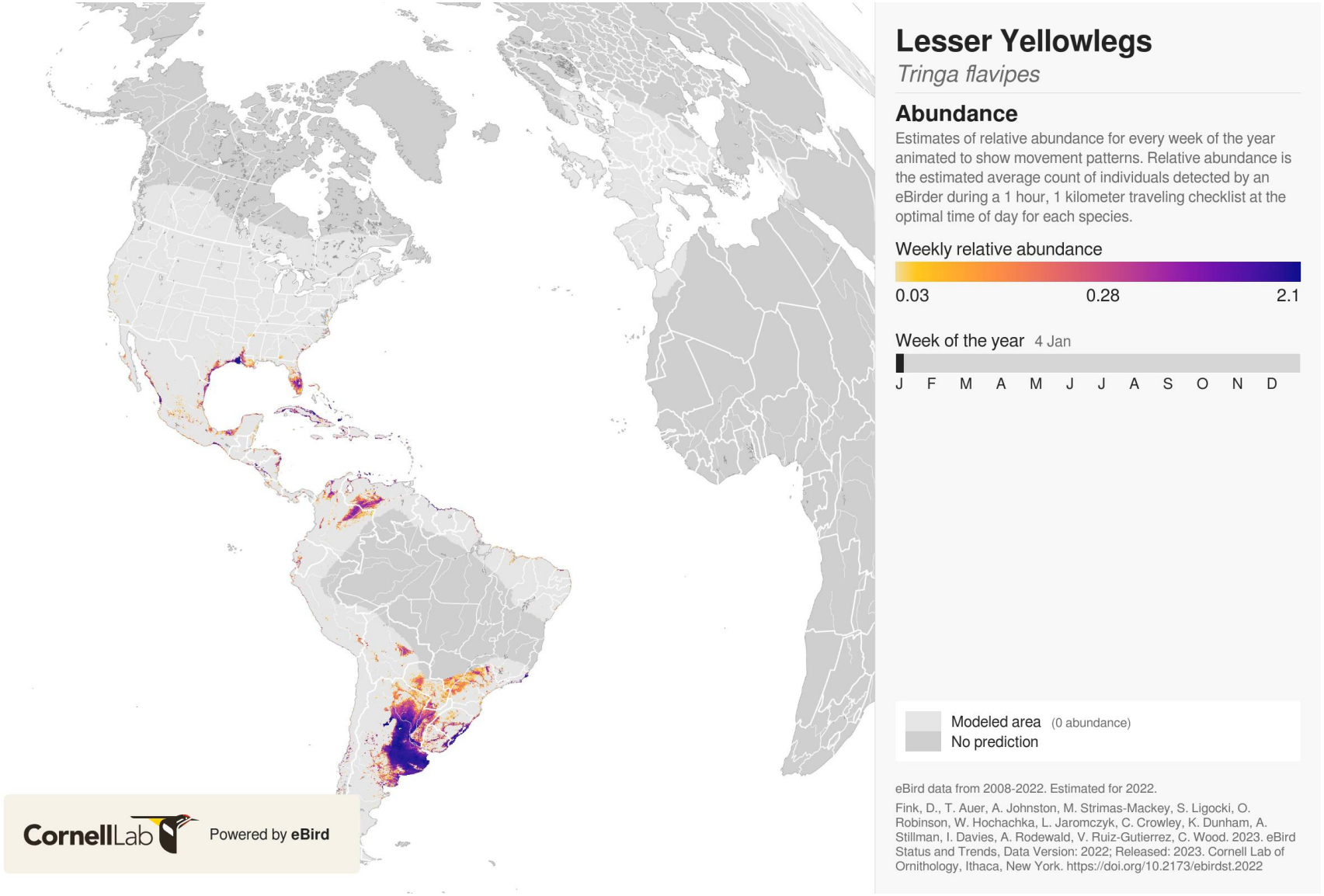
GPS tracking data

Image credit: Chris Harwood

Image credit: Laura McDuffie

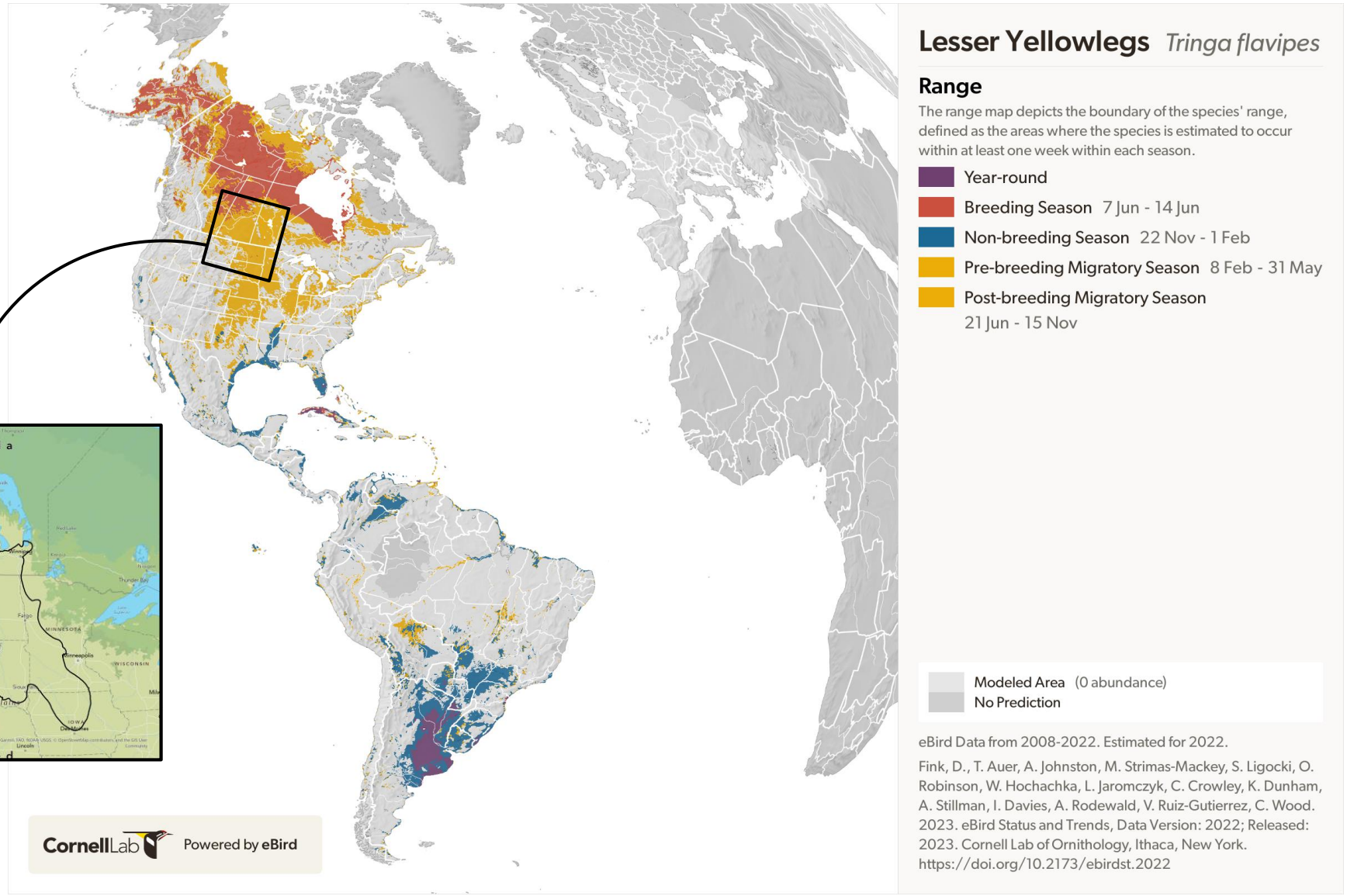
Lesser Yellowlegs migrate

Bird migration – biannual movement of migratory birds between breeding and wintering grounds. Typically, birds migrate northwards in the Spring (March 1 to June 15) and southwards in the Fall (August 1 to November 15). Non-migratory birds remain in the same place throughout the year.



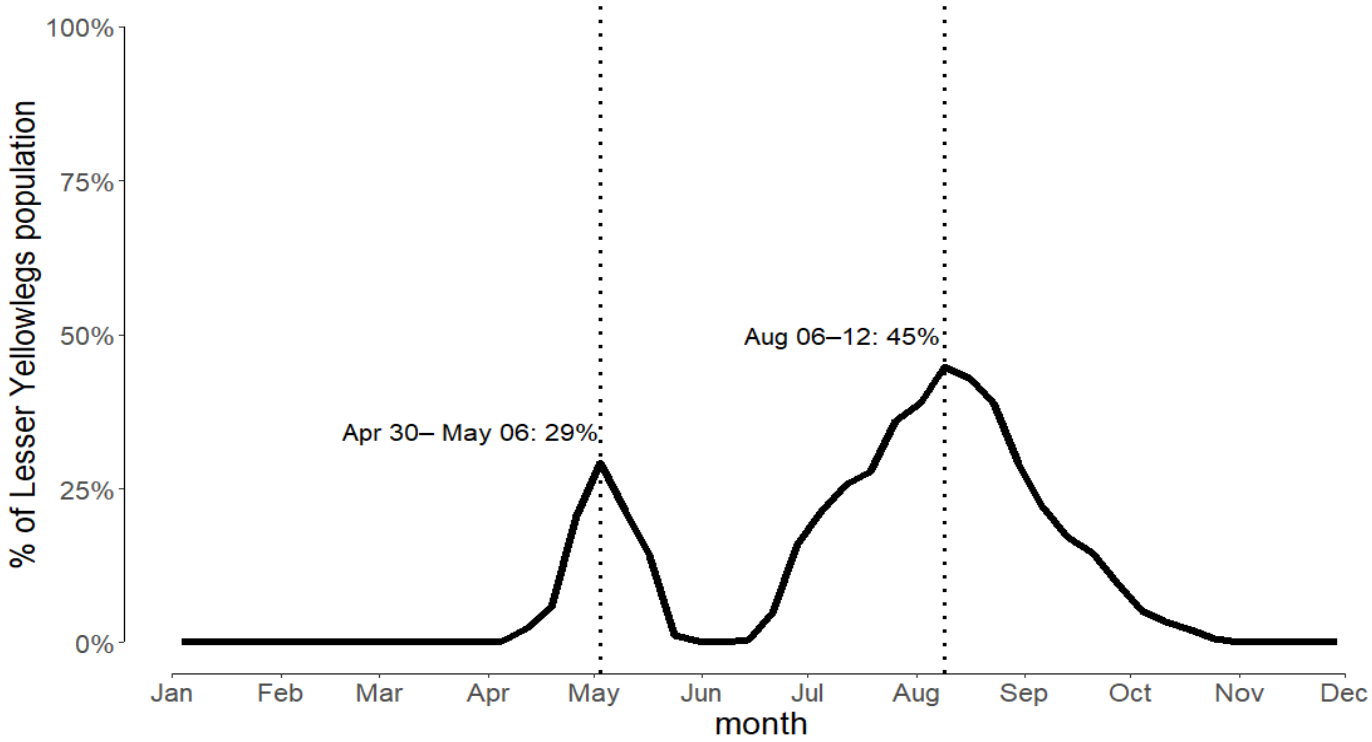
Stopover site – locations where migratory birds rest and refuel along their migratory journey.

Lesser Yellowlegs migrate



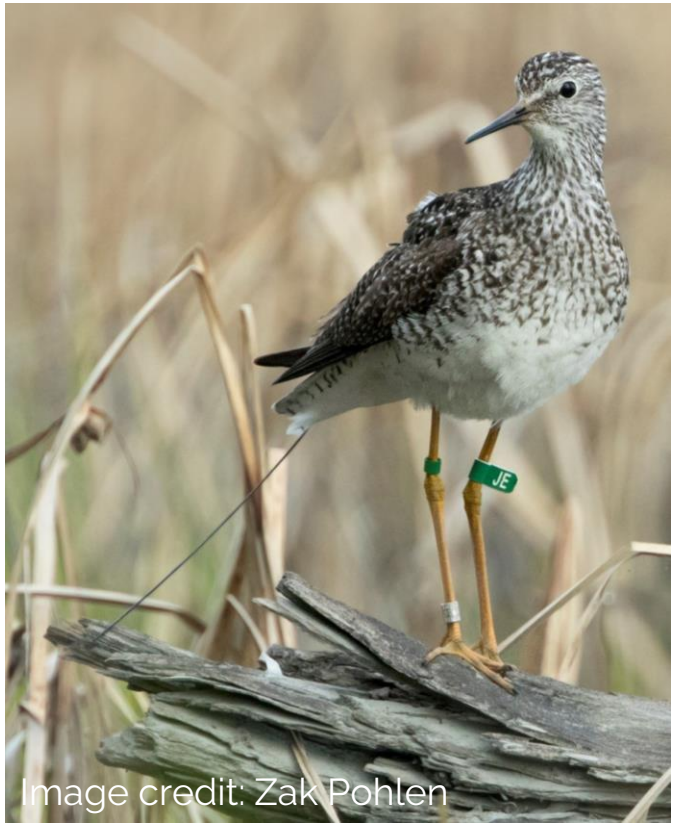
Lesser Yellowlegs stop by the prairie potholes

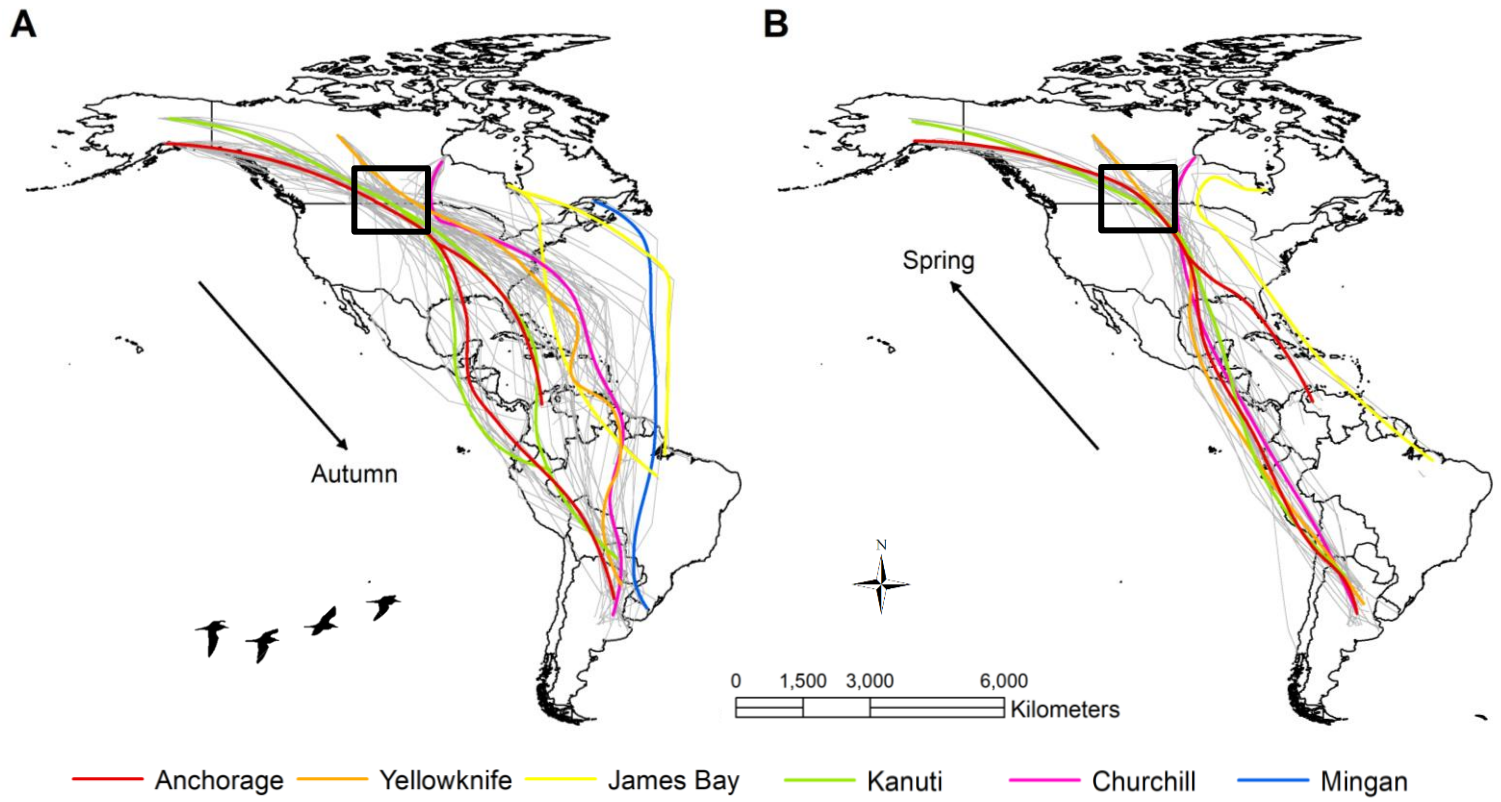

Photo credit: USFWS Mountain-Prairie



Data sourced from Fink et al. 2023

Lesser Yellowlegs stop by the prairie potholes

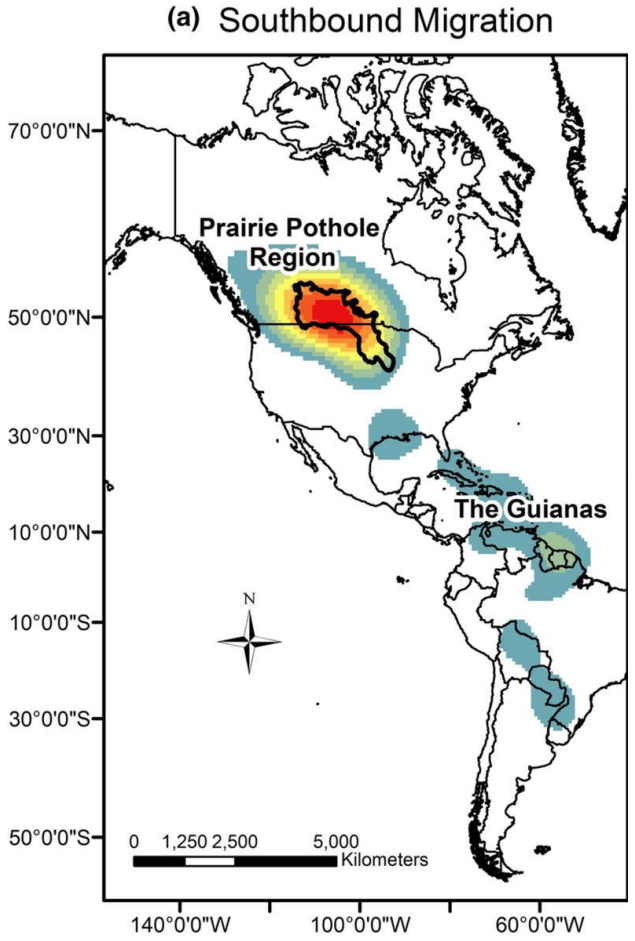


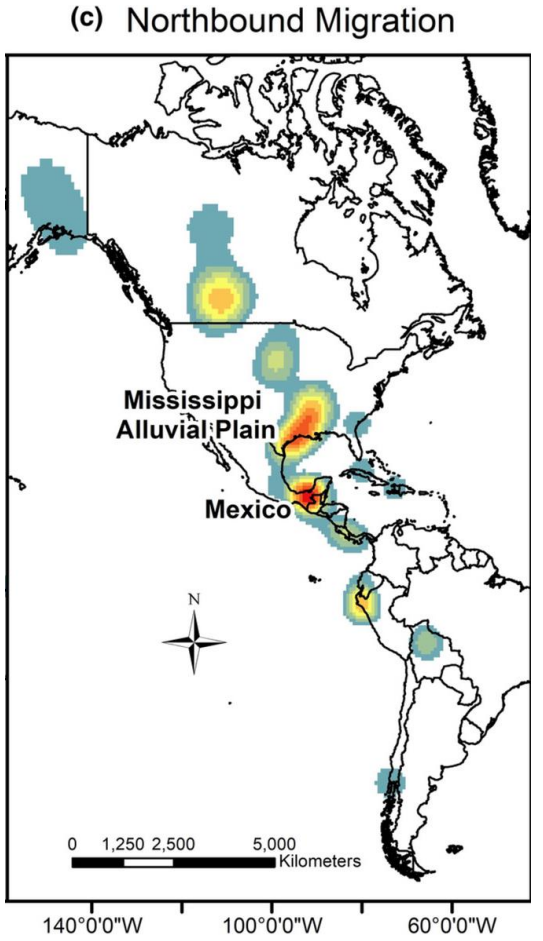


n = 115

McDuffie et al. 2022

Lesser Yellowlegs stop by the prairie potholes

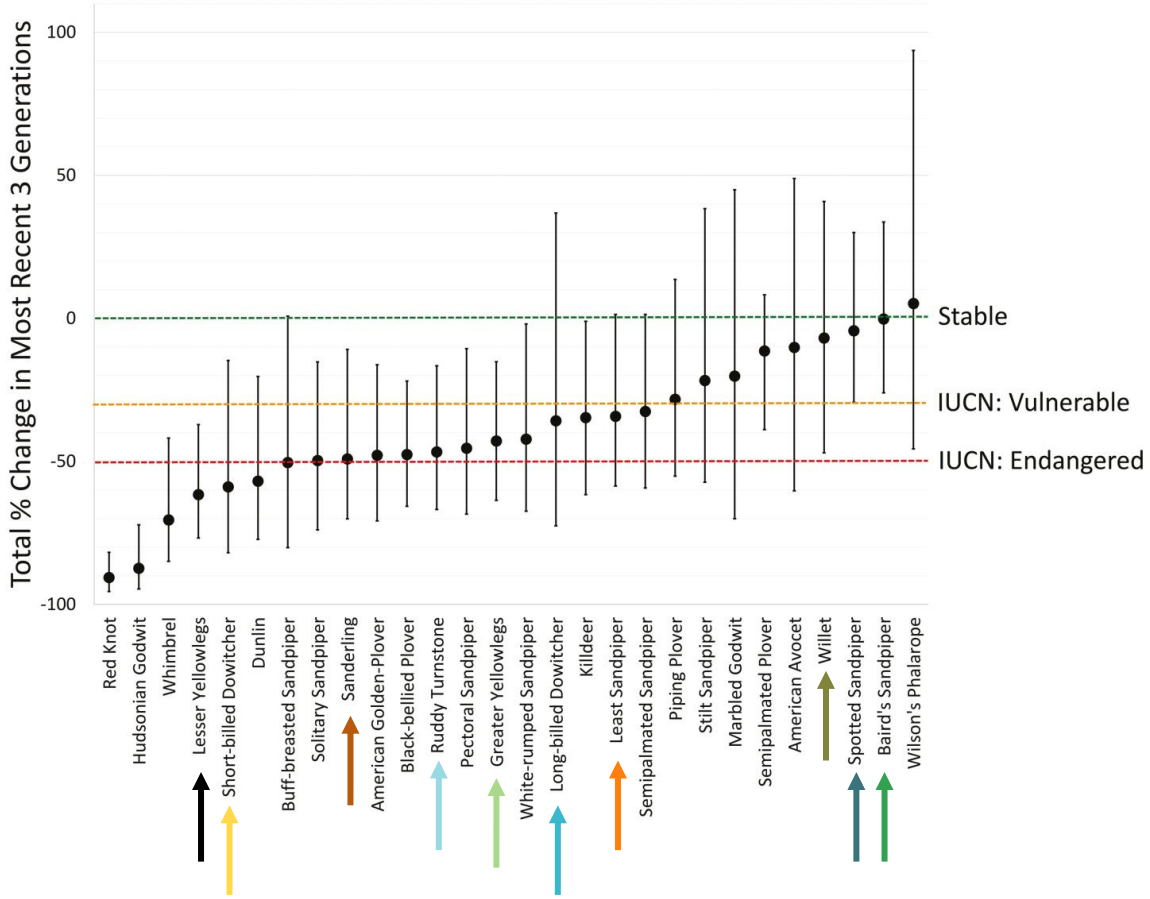




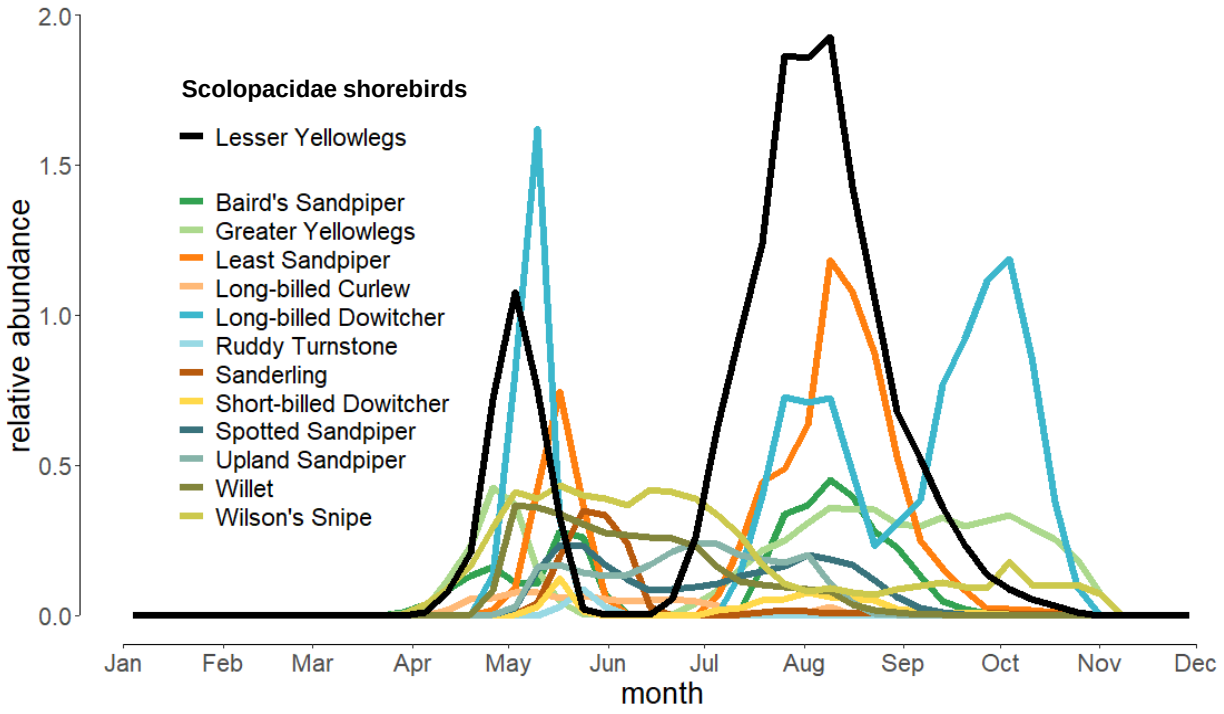
McDuffie et al. 2022

Relative abundance – count of individuals detected by an expert eBirder on a 1 hour, 2 kilometer traveling checklist at the optimal time of day.

The Prairie Pothole Region is an important stopover area

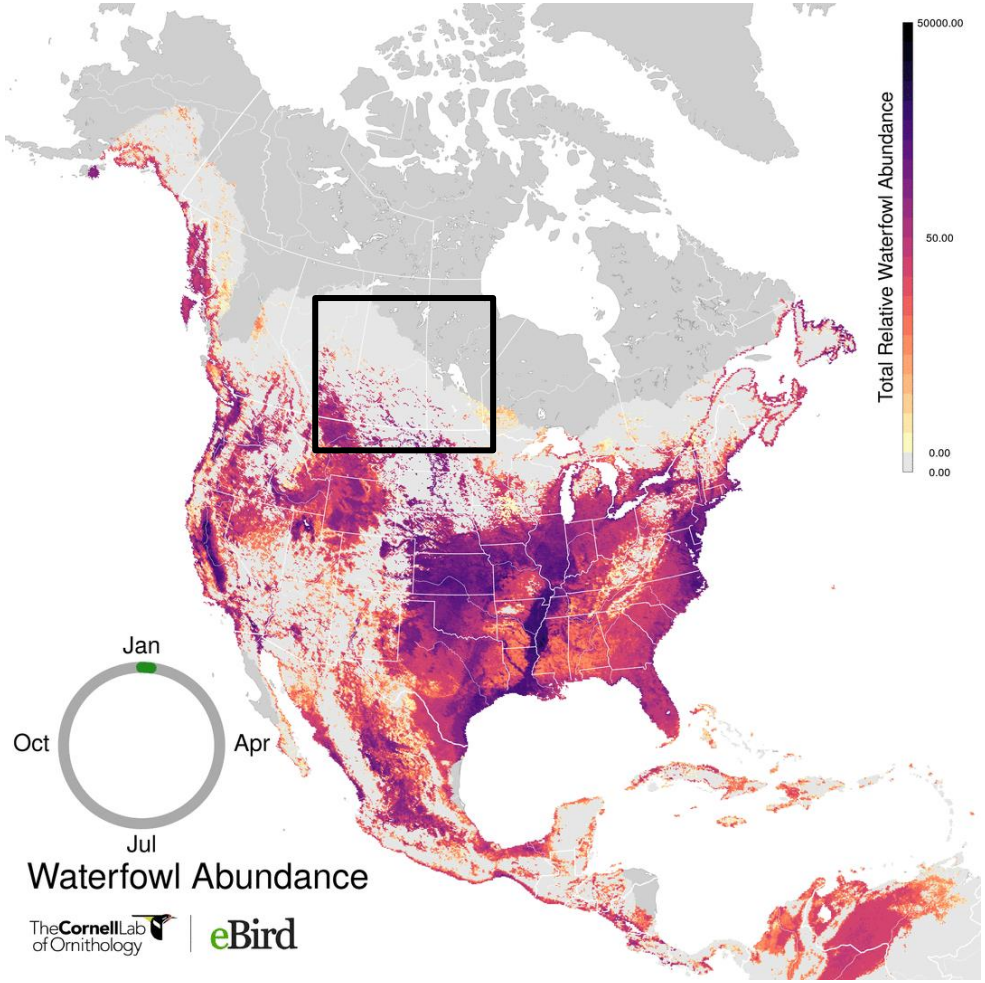


Smith et al. 2023



Data sourced from Fink et al. 2023

The Prairie Pothole Region is an important stopover area

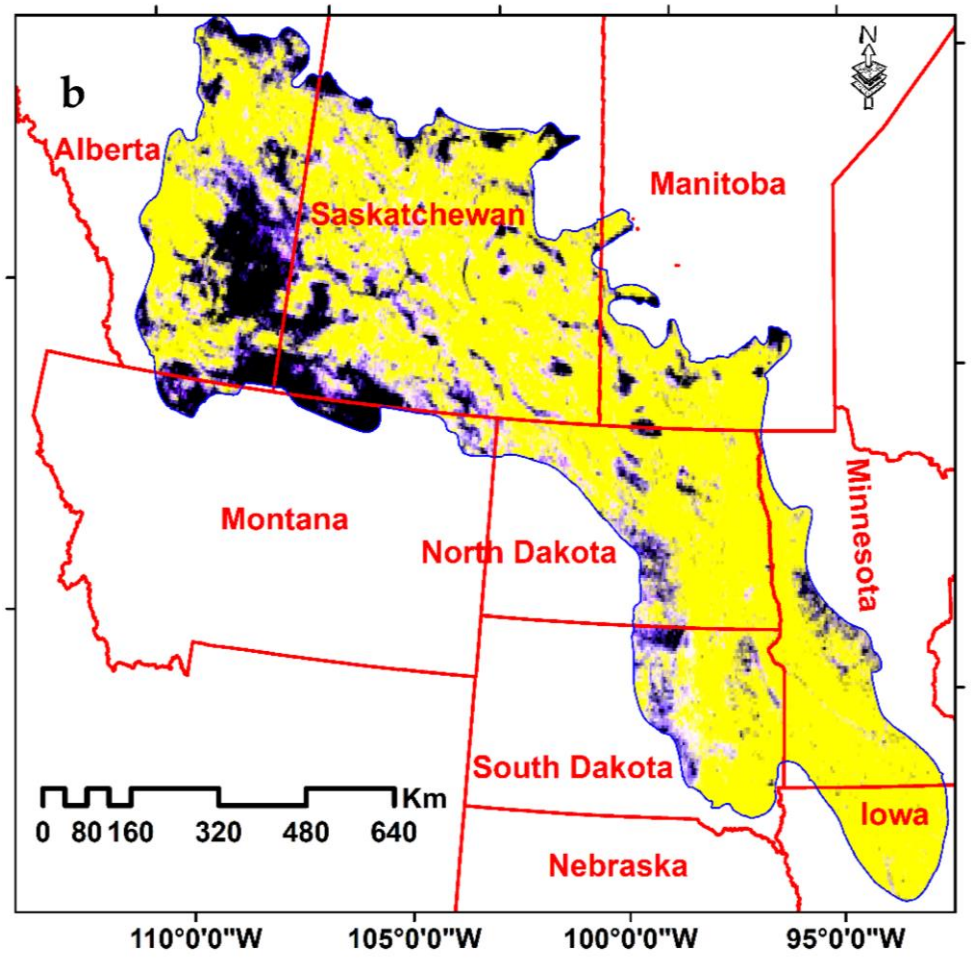


Fink et al. 2020

The Prairie Pothole Region is an important stopover area


Photo credit: USFWS Mountain-Prairie

The Prairie Pothole Region has been transformed by agriculture



60-70% wetlands lost

Alemu al. 2020

Lesser Yellowlegs stop to rest and refuel

Benefits

- Accumulate energy
- Physical recovery
- Avoid adverse environmental conditions
- Minimize predation
- Spatiotemporal adjustments to migration

Delayed or immediate costs

- Poor feeding conditions
- Non-optimal arrival time
- Disease exposure
- Predation risk

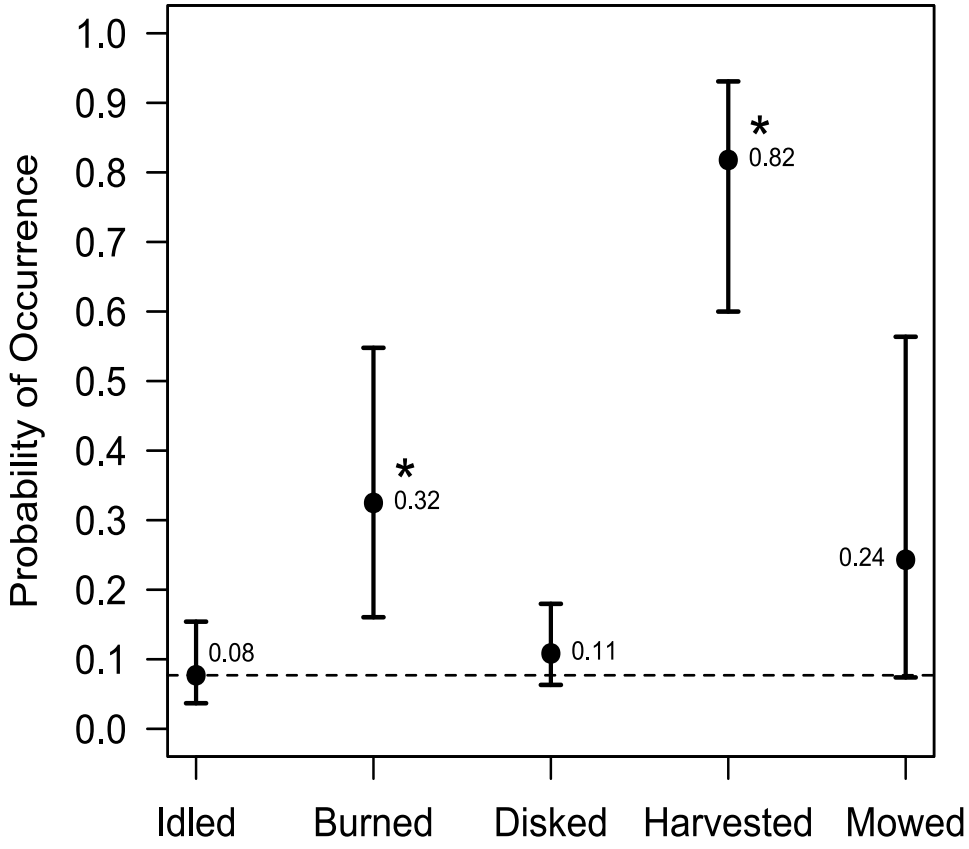

Photo credit: USFWS Mountain-Prairie

Lesser Yellowlegs select resources at different scales

Eric S. Liner, ML 463837.
Accessible at https://macaulaylibrary.org/asset/463837.

Lesser Yellowlegs select wetlands in croplands

- Temporary
- Minimal emergent vegetation
- Large perimeters
- Proximal to other wetlands
- Recently manipulated?



Toy et al. 2024

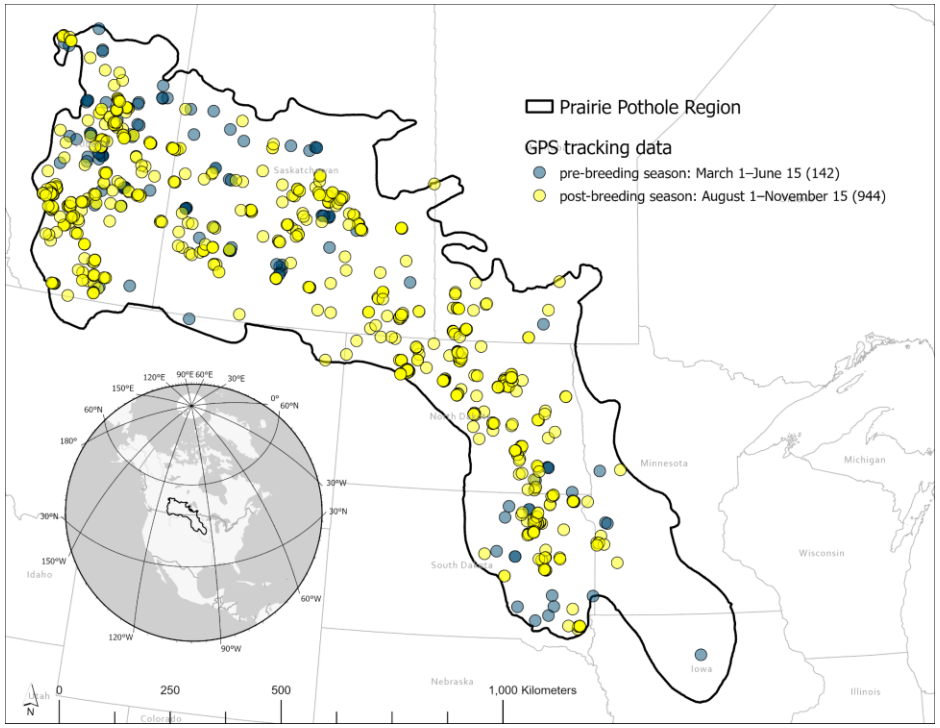
Objectives

1) Determine critical habitat features

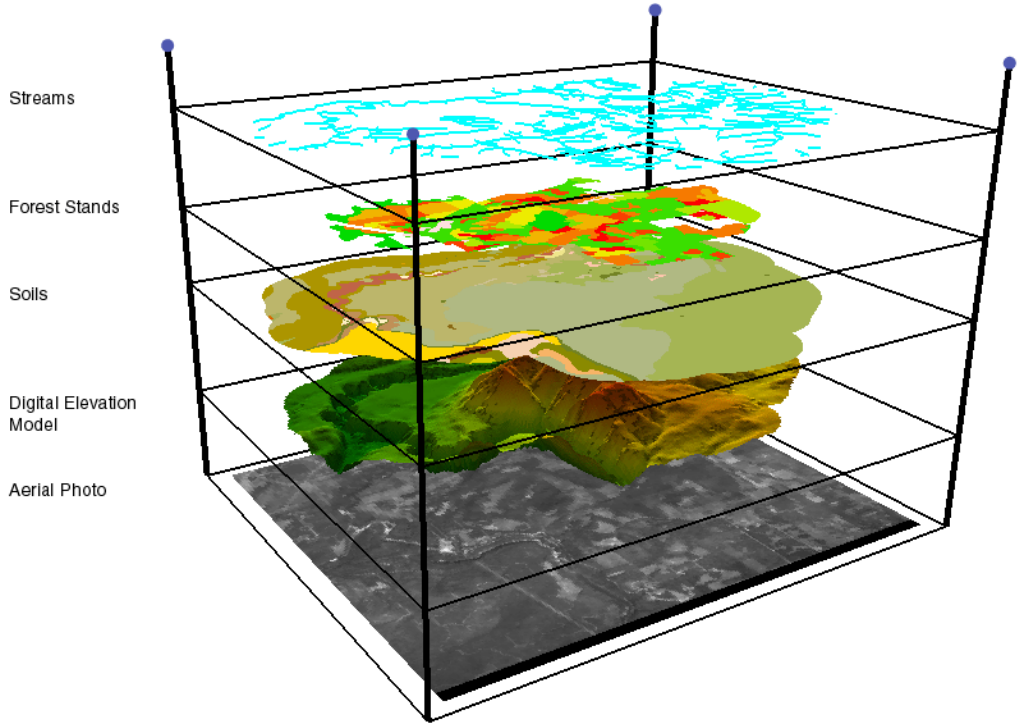
2) Understand impacts of future land use and land cover change scenarios

1) Determine critical habitat features

Do Lesser Yellowlegs use habitat features as a migratory stopover cue in the Prairie Pothole Region?



+



Data sourced from McDuffie & Johnson 2024

1) Determine critical habitat features

Do Lesser Yellowlegs use habitat features as a migratory stopover cue in the Prairie Pothole Region?

Lesser Yellowlegs select agricultural wetlands over non-agricultural or idle.

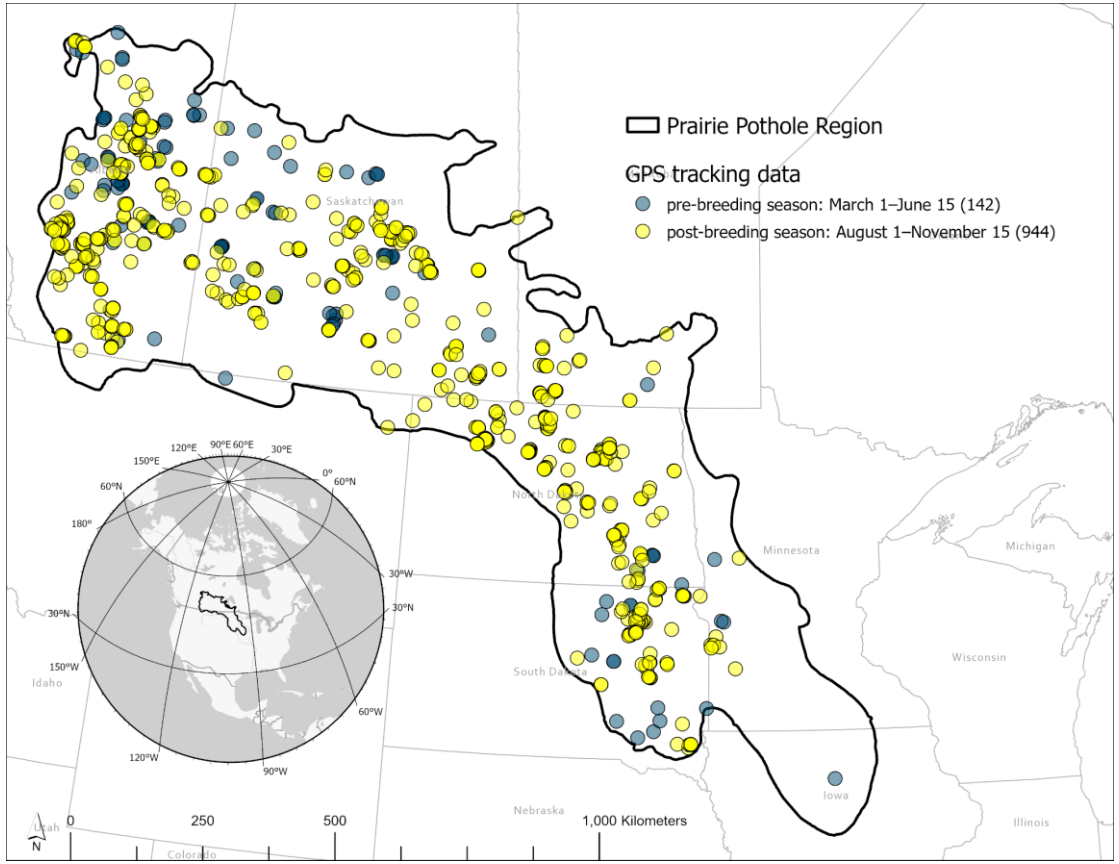
Is habitat feature selection by Lesser Yellowlegs scale-dependent?

Lesser Yellowlegs select agricultural wetlands at the local scale and areas with a higher density of wetlands at the landscape scale.

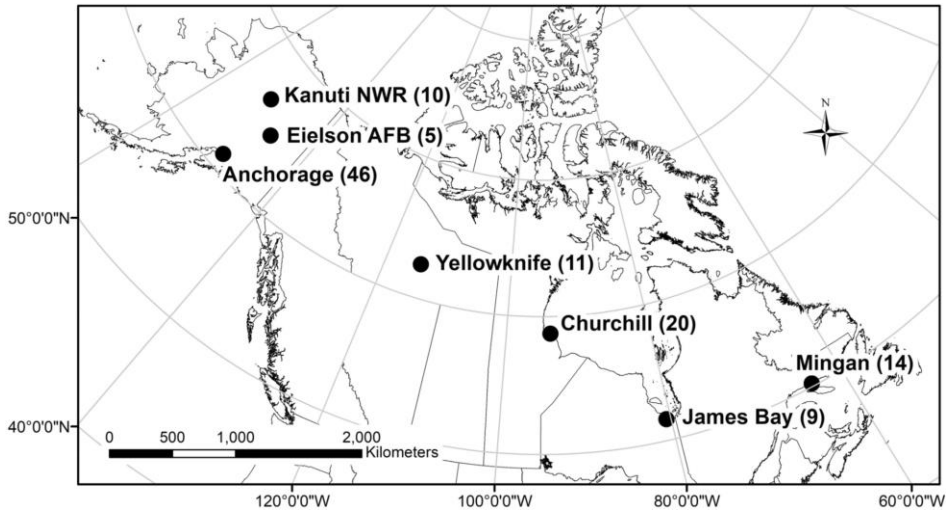
Are habitat features selected by Lesser Yellowlegs uniformly distributed across the Prairie Pothole Region?

Habitat features selected by Lesser Yellowlegs occur in patches uniformly distributed across the PPR.

1) Determine critical habitat features



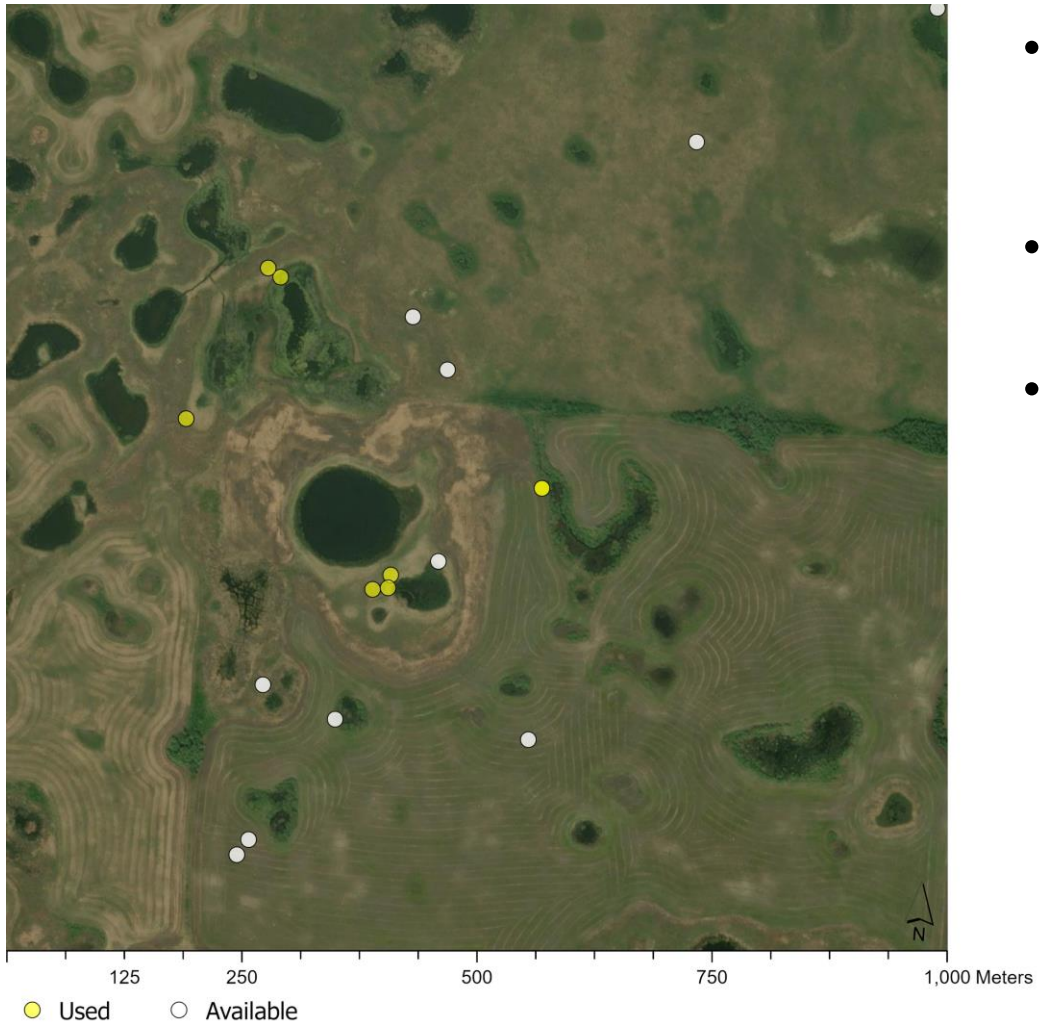
Data sourced from McDuffie & Johnson 2024



McDuffie et al. 2022

- 4g PinPoint GPS Argos-75 satellite tags
- 118 Lesser Yellowlegs tagged across the breeding range
- 63 individuals provided partial migratory tracks
- 52 individuals provided full migratory tracks (north/southbound migration).
- Locations with ±10 m accuracy

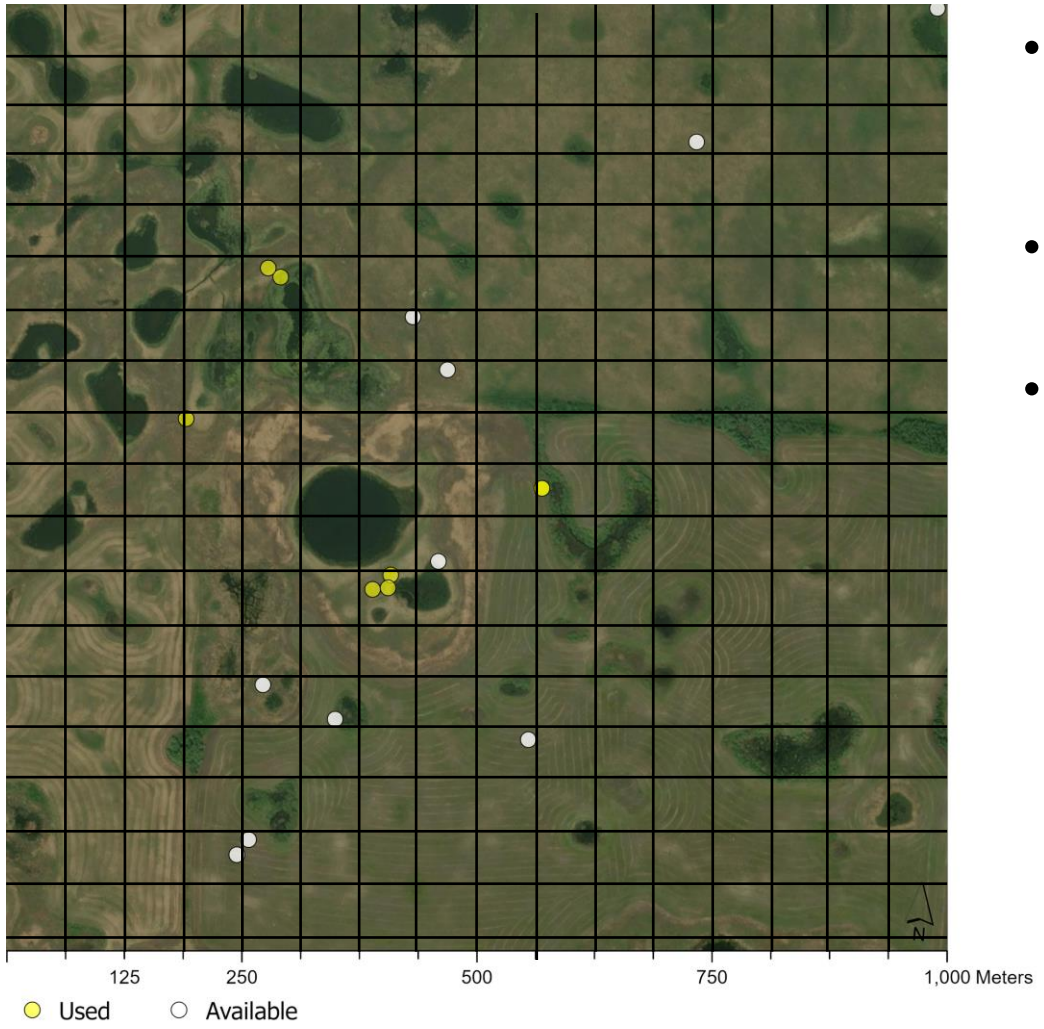
1) Determine critical habitat features



- Resource Selection Functions (RSF) compute the probability of use of specified landscape features and identifies species-habitat associations
- “Used” locations – where individuals were known to be present
- ”Available” locations – where individuals are supposed to be absent (pseudo-absent)

Data sourced from McDuffie & Johnson 2024

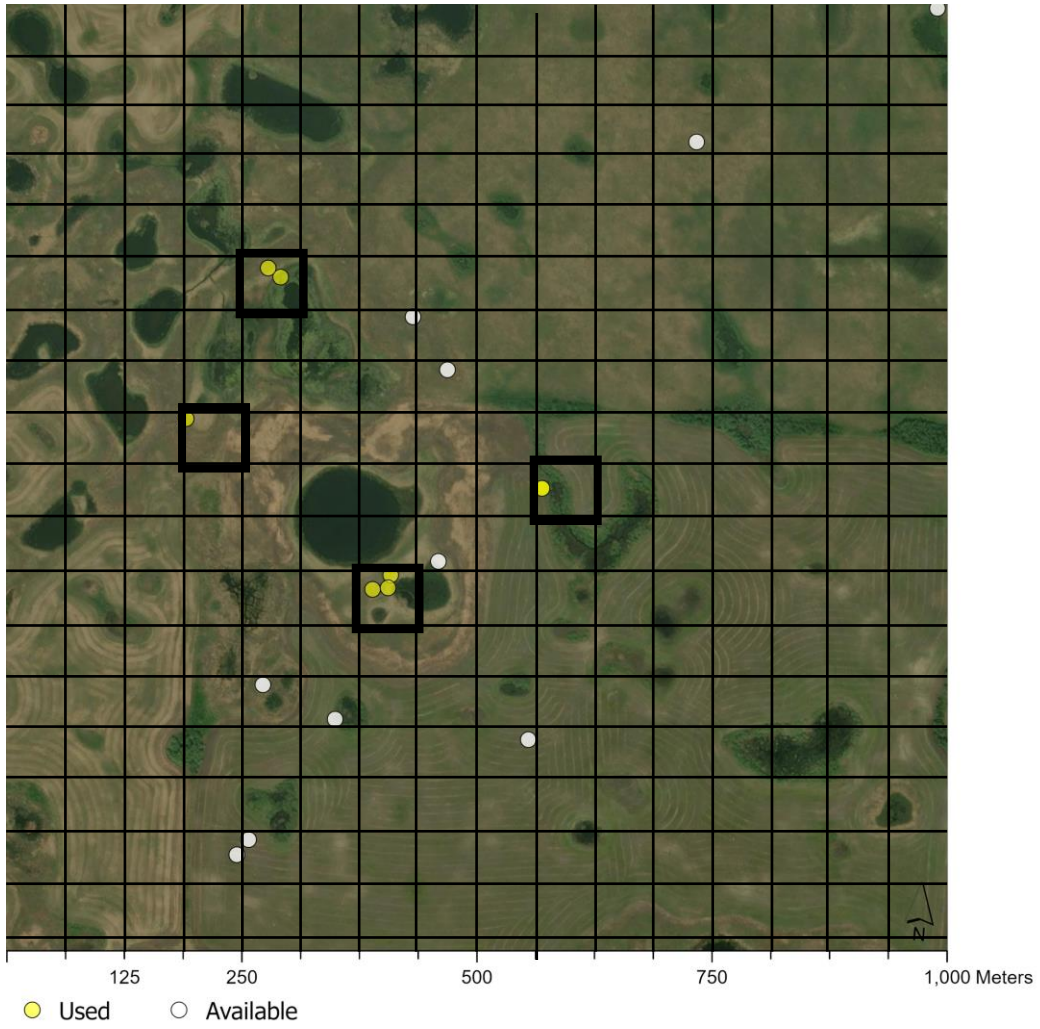
1) Determine critical habitat features



- Resource Selection Functions (RSF) compute the probability of use of specified landscape features and identifies species-habitat associations
- “Used” locations – where individuals were known to be present
- ”Available” locations – where individuals are supposed to be absent (pseudo-absent)

Data sourced from McDuffie & Johnson 2024

1) Determine critical habitat features

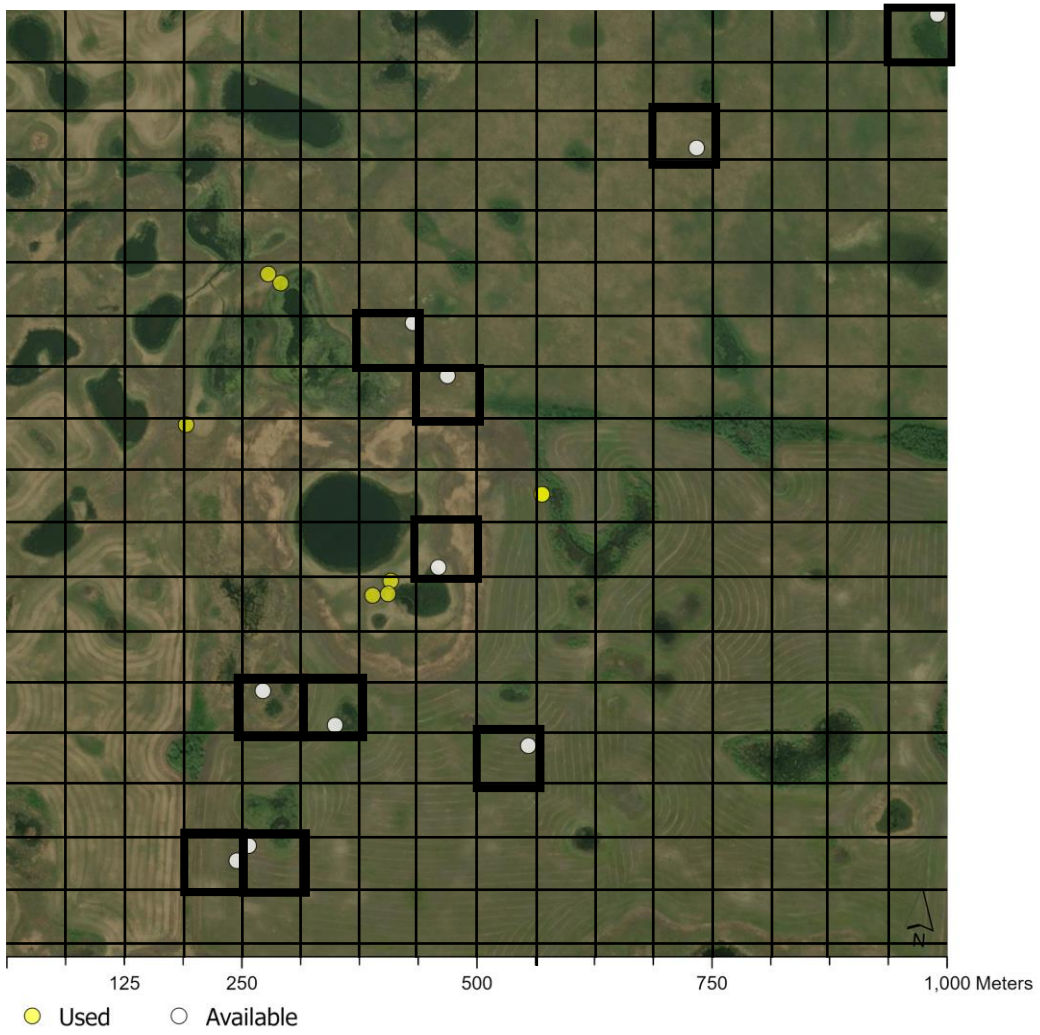


Habitat covariates

- Seasonal water (% cover)
- Elevation 30m (median)
- Permanent water (% cover)
- Nighttime Lights (mean)
- Enhanced Vegetation Index (median)
- Herbaceous Croplands (% cover)
- Dense Herbaceous (% cover)
- Lakes (% cover)
- …

Data sourced from McDuffie & Johnson 2024

1) Determine critical habitat features



Habitat covariates

- Seasonal water (% cover)
- Elevation 30m (median)
- Permanent water (% cover)
- Nighttime Lights (mean)
- Enhanced Vegetation Index (median)
- Herbaceous Croplands (% cover)
- Dense Herbaceous (% cover)
- Lakes (% cover)
- …

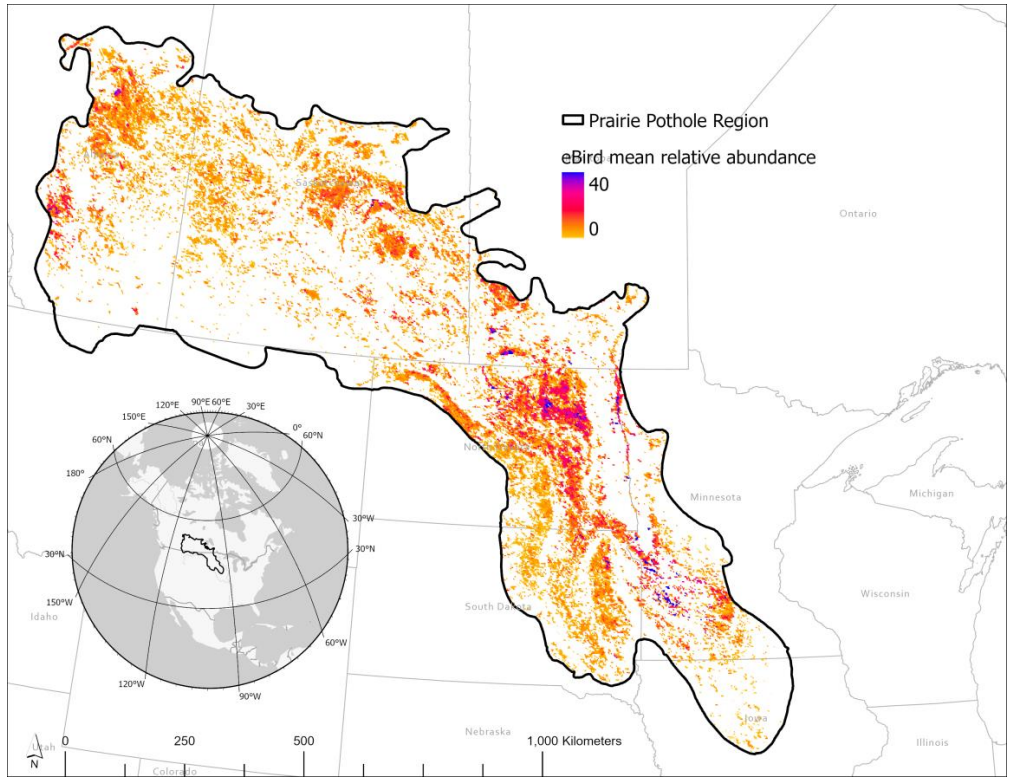
Data sourced from McDuffie & Johnson 2024

1) Determine critical habitat features

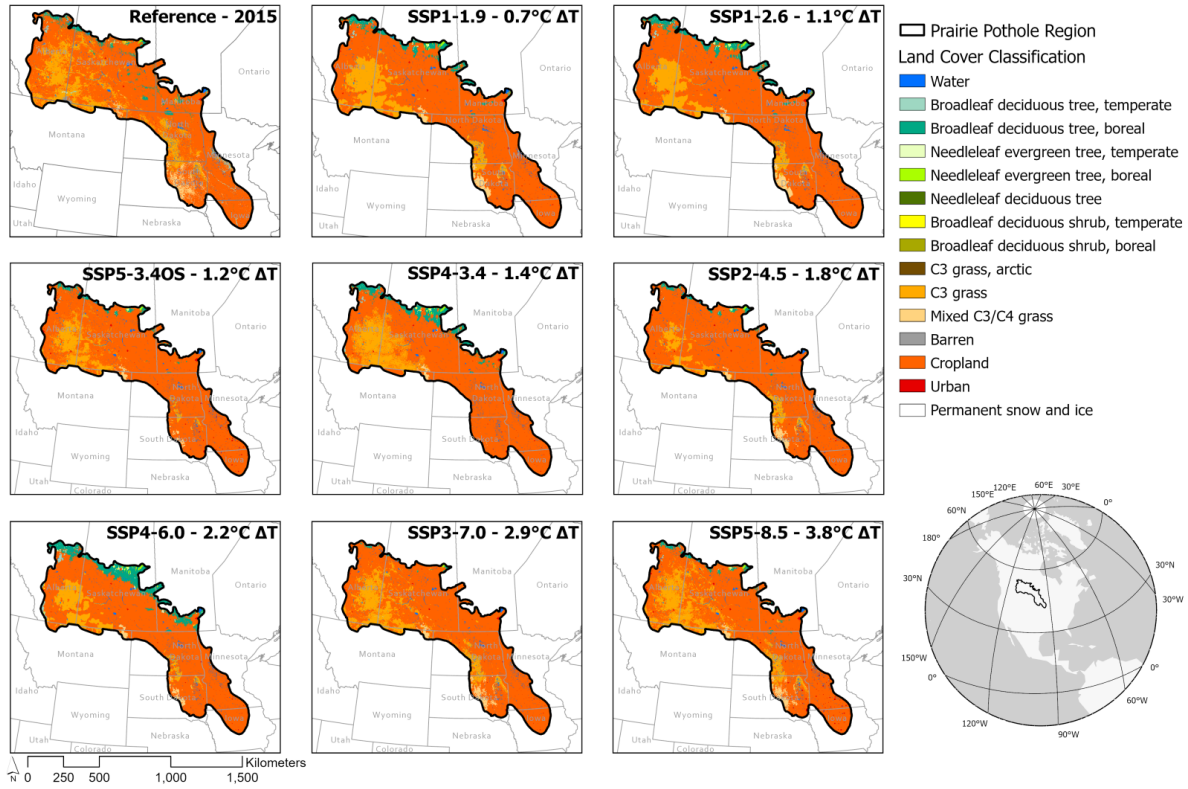
a. Subset GPS tracking data into training and test datasets
b. Assess multicollinearity of covariates using Pearson correlation coefficient (PCC)
c. Compute a series of Resource Selection Functions to estimate the probability of use for individual habitat covariates at multiple scales
d. Assess RSF models using Akaike Information Criteria (AIC)
e. Evaluate the relative contributions of the covariates to model results
f. Evaluate the predictive ability of models with test dataset using k-fold cross-validation scores
g. Generate habitat suitability maps using the “best fit” RSF

2) *Understand impacts of future land use and land cover change scenarios*

Do future environmental scenarios alter habitat features selected by Lesser Yellowlegs?



Fink et al. 2023



Chen & Liu 2022

2) *Understand impacts of future land use and land cover change scenarios*

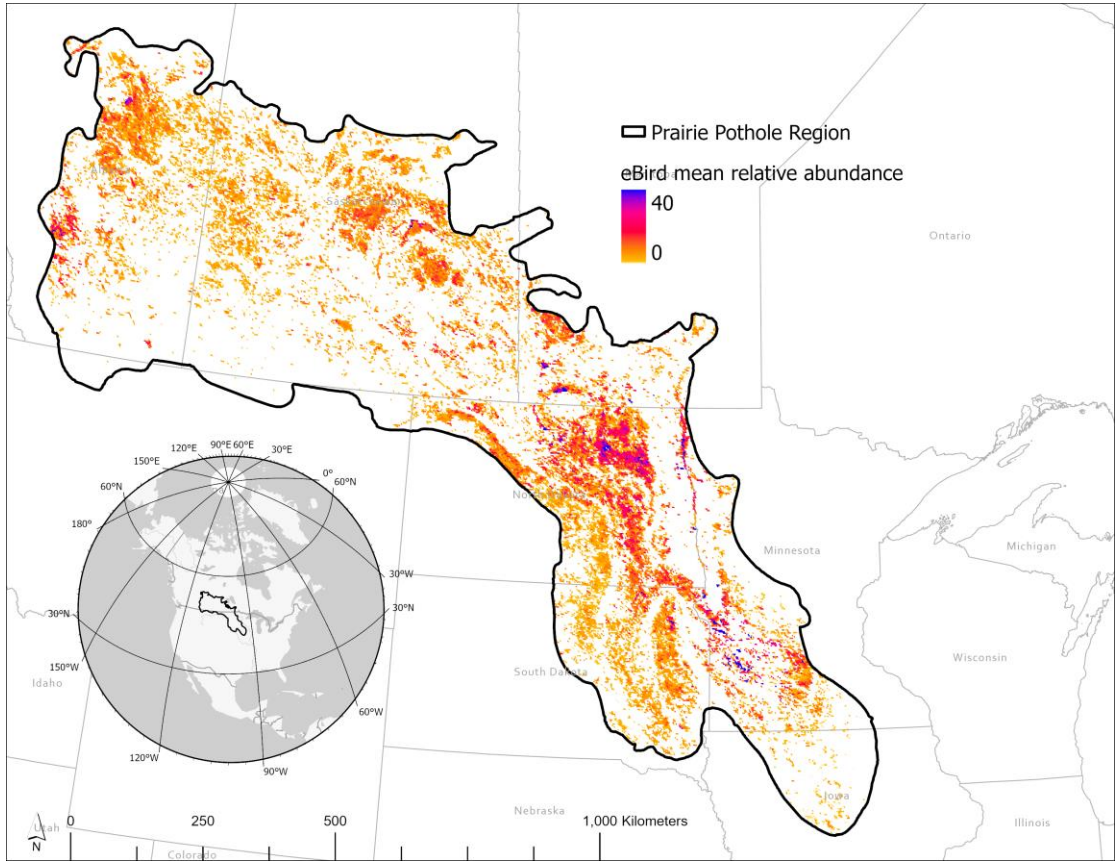
Do future environmental scenarios alter habitat features selected by Lesser Yellowlegs?

Agricultural wetlands will decline in the Prairie Pothole Region due to more frequent multi-year droughts and additional cropland expansion.

Will future environmental scenarios alter Lesser Yellowlegs distribution during migration?

More frequent multi-year droughts will shift the distribution of Lesser Yellowlegs towards regions with more permanent wetlands.

2) *Understand impacts of future land use and land cover change scenarios*

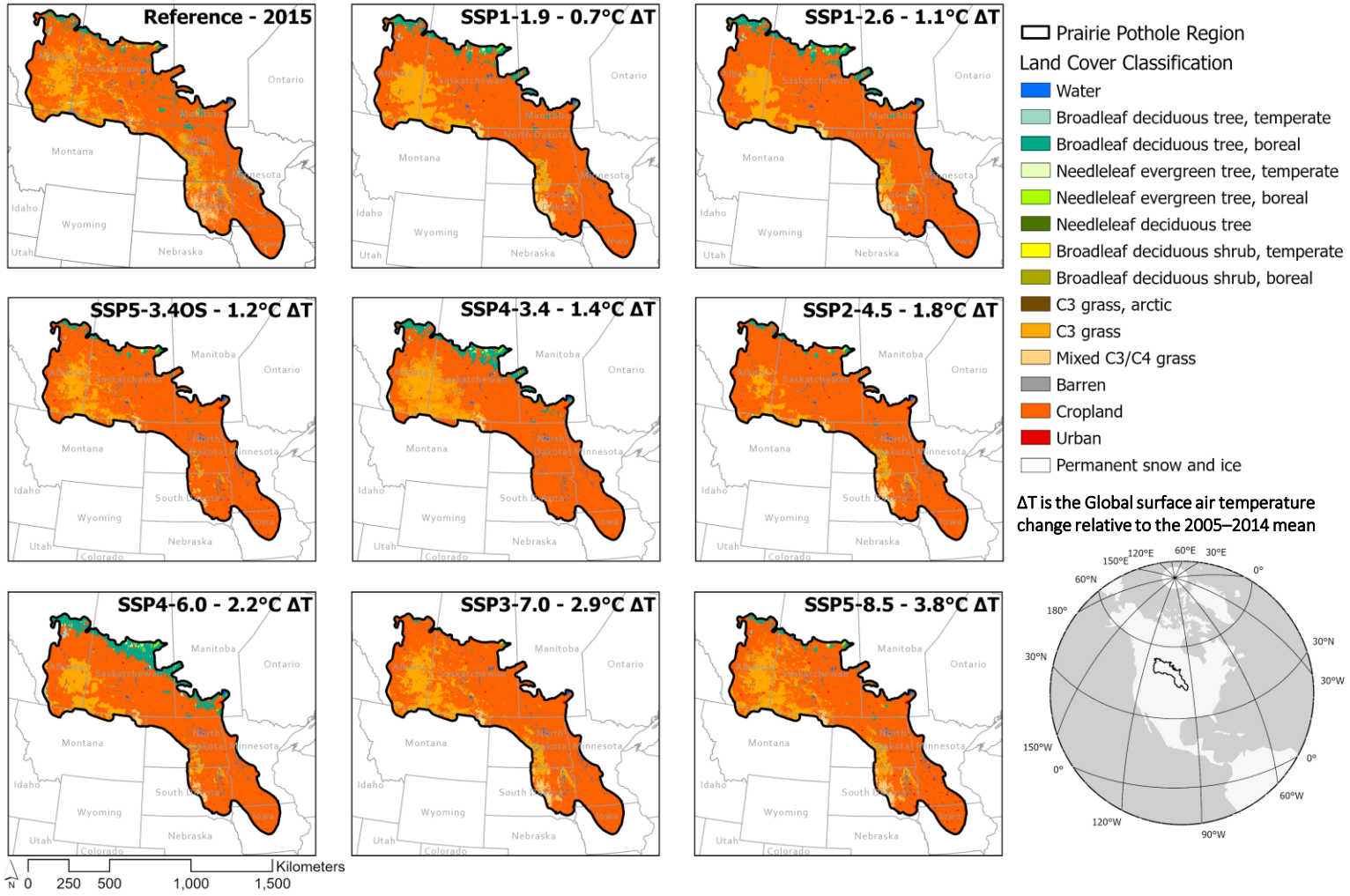


- 53 million eBird checklists from 16 million unique locations from 2008–2022
- Range-wide estimates of occurrence and abundance
- 3-km resolution
- Adaptive Spatio-Temporal Exploratory Models
- Predictor variables that account for variability of detection, time, and environment

***Relative abundance** – the estimated number of individuals that could be detected by an eBirder during a 1-hour, 2-kilometer traveling checklist at the optimal time of day.*

Fink et al. 2023

2) *Understand impacts of future land use and land cover change scenarios*



- 1 km global projections of 20 plant functional types (PFTs)
- 5-year intervals from 2020-2100
- Eight “most likely” SSP-RCP scenarios identified by the Coupled Model Intercomparison Project (CMIP6)

Shared Socio-Economic (SSPs) – “narratives” that characterize future social and economic developments based on assumptions about population growth, land use, and technological innovations.

Representative Concentration Pathways (RCPs) – predict radiative forcing in watts per square meter, which translates to the change in the earth’s energy balance and serves as a proxy for climate change.

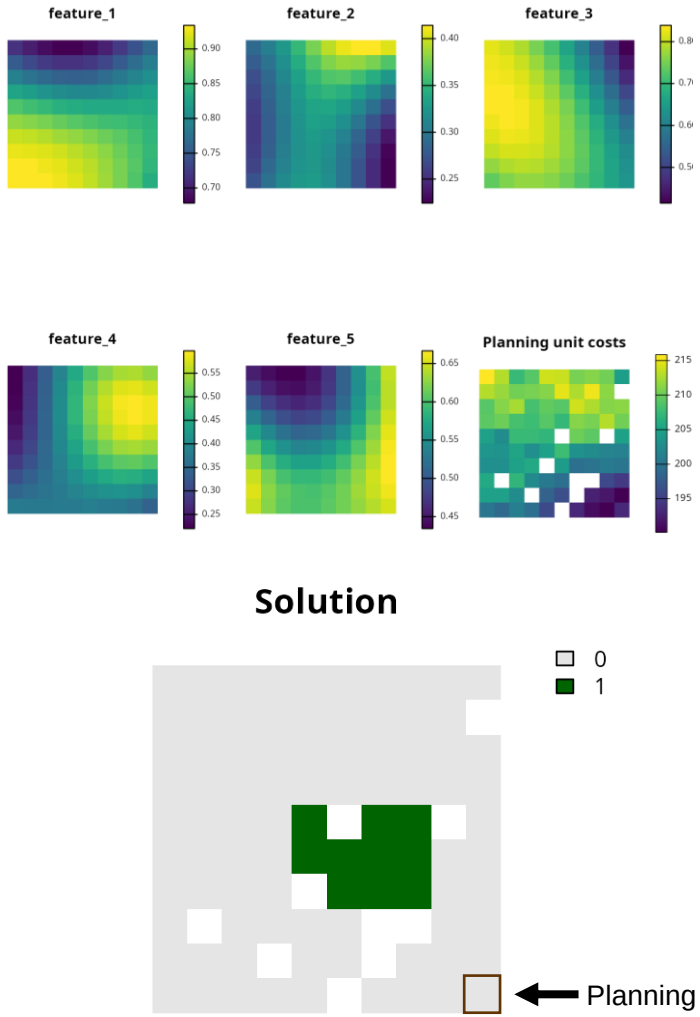
Chen & Liu 2022

2) *Understand impacts of future land use and land cover change scenarios*

a. Develop a series of Species Distribution Models (SDMs) to estimate Lesser Yellowlegs distribution in the Prairie Pothole Region under each SSP-RCP scenario
b. Assess SDMs using Akaike Information Criteria (AIC)
c. Calculate the change of suitable habitat from 2020 to 2100 under each SSP-RCP scenario
d. Generate maps displaying projected changes in species distribution by 2100 under each SSP-RCP scenario

Next steps

Identify cost-efficient areas to conserve critical habitat features for Lesser Yellowlegs recovery



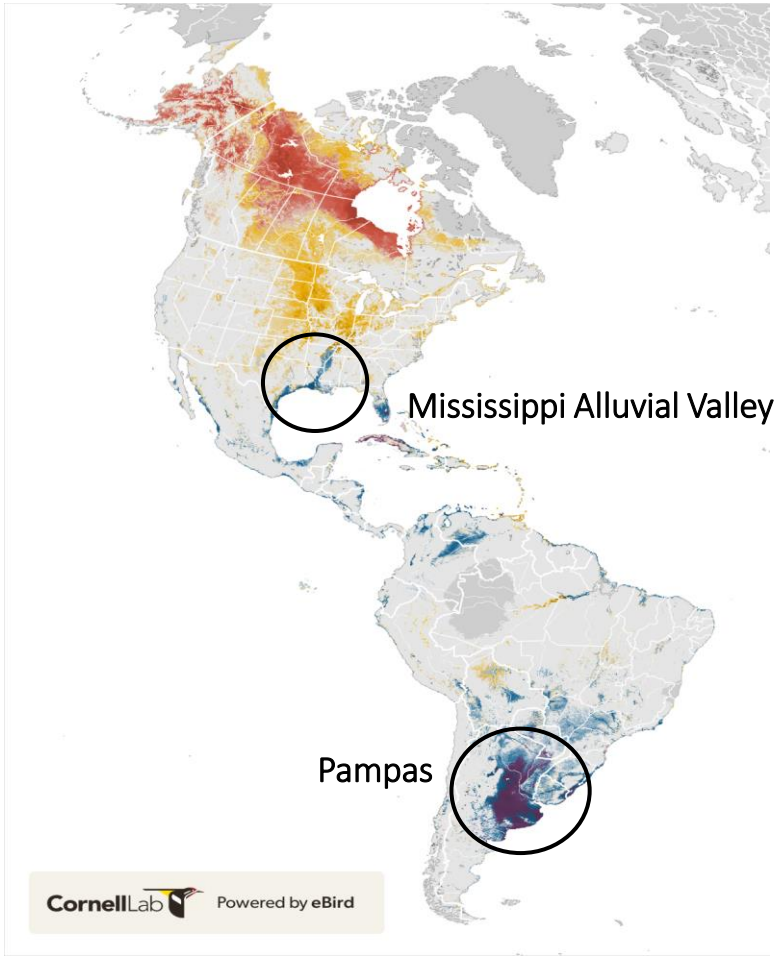
- Marxan software solves the minimum-set problem – minimize the cost and boundary of planning units necessary to meet conservation targets.
- Inputs
  - Critical habitat features (Objective 1)
  - Probability that each feature will exist in the future (Objective 2)
  - Conservation targets for each feature (stakeholder input)
  - Management costs (stakeholder input)
- Outputs
  - conservation planning “solutions”
  - selection frequencies of individual planning units (counties)

The results will inform a Lesser Yellowlegs strategic recovery plan

Photo credit: USFWS Midwest Region

..with impacts beyond yellowlegs and the prairie


Photo credit: USFWS Mountain-Prairie



Works cited

Alemu, W. G., Henebry, G. M. Melesse, A. M. (2020). Land Cover and Land Use Change in the US Prairie Pothole Region Using the USDA Cropland Data Layer. Land 9(5), 166. https://doi.org/10.3390/land9050166

Chen, G., Li, X., & Liu, X. (2022). Global land projection based on plant functional types with a 1-km resolution under socio-climatic scenarios. *Scientific Data*, *9*(1). https://doi.org/10.1038/s41597-022-01208-6

Fink, D., Auer, T., Johnston, A., Strimas-Mackey, M., Robinson, O., Ligocki, S., Petersen, B., Wood, C., Davies, I., Sullivan, B., Iliff, M., Kelling, S. (2020). eBird Status and Trends, Data Version: 2018; Released: 2020. Cornell Lab of Ornithology, Ithaca, New York. https://doi.org/10.2173/ebirdst.2018

Fink, D., Auer, T., Johnston, A., Strimas-Mackey, M., Ligocki, S., Robinson, O., Hochachka, W., Jaromczyk, L., Crowley, C., Dunham, K., Stillman, A., Davies, I., Rodewald, A., Ruiz-Gutierrez, V., & Wood, C. (2023). *eBird Status and Trends, Data Version: 2022*. Cornell Lab of Ornithology. https://doi.org/https://doi.org/10.2173/ebirdst.2022

Handel, C. M., & Sauer, J. R. (2017). Combined analysis of roadside and off-road Breeding Bird Survey data to assess population change in Alaska. The Condor, 119(3), 557–575. https://doi.org/10.1650/CONDOR-17-67.1

McDuffie, L. A., Christie, K. S., Taylor, A. R., Nol, E., Friis, C., Harwood, C. M., Rausch, J., Laliberte, B., Gesmundo, C., Wright, J. R., & Johnson, J. A. (2022). Flyway-scale GPS tracking reveals migratory routes and key stopover and non-breeding locations of lesser yellowlegs. Ecology and Evolution, 12(11). https://doi.org/10.1002/ece3.9495

McDuffie, L., & Johnson, J. (2024). *U.S. Fish and Wildlife Service Tracking Data for Lesser Yellowlegs (Tringa flavipes)*. U.S. Geological Survey data release. https://doi.org/https://doi.org/10.5066/P9C7JWCC

Smith, P. A., Smith, A. C., Andres, B., Francis, C. M., Harrington, B., Friis, C., Morrison, R. I. G., Paquet, J., Winn, B., & Brown, S. (2023). Accelerating declines of North America's shorebirds signal the need for urgent conservation action. Ornithological Applications. https://doi.org/10.1093/ornithapp/duad003

Tibbitts, T. L., & Moskoff, W. (2020). Lesser Yellowlegs (Tringa flavipes). In A. F. Poole (Ed.), *Birds of the World*. Cornell Lab of Ornithology. https://doi.org/10.2173/bow.lesyel.0114

Toy, D. L., Anteau, M. J., Pearse, A. T., DeKeyser, E. S., & Roberts, D. C. (2024). Manipulation of Farmed Wetlands Increases use by Migrating Shorebirds and Ducks. *Wetlands*, *44*(7). https://doi.org/10.1007/s13157-024-01819-2