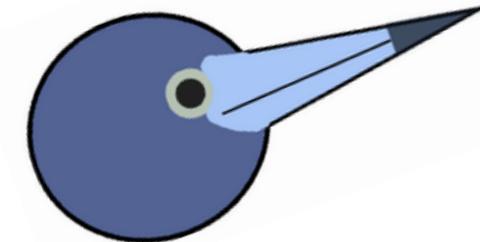


# Contributions of geographically isolated wetlands to **bird** **biodiversity** across the conterminous United States



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**UF | IFAS**  
UNIVERSITY *of* FLORIDA



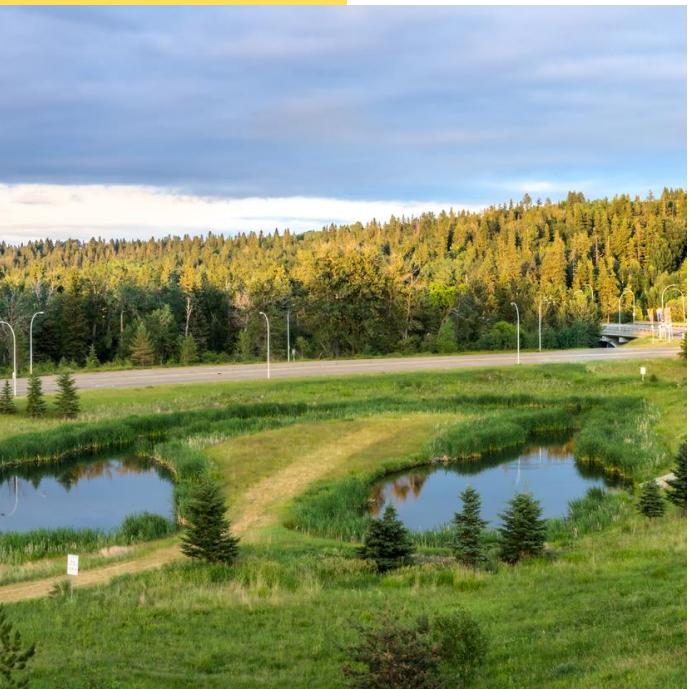
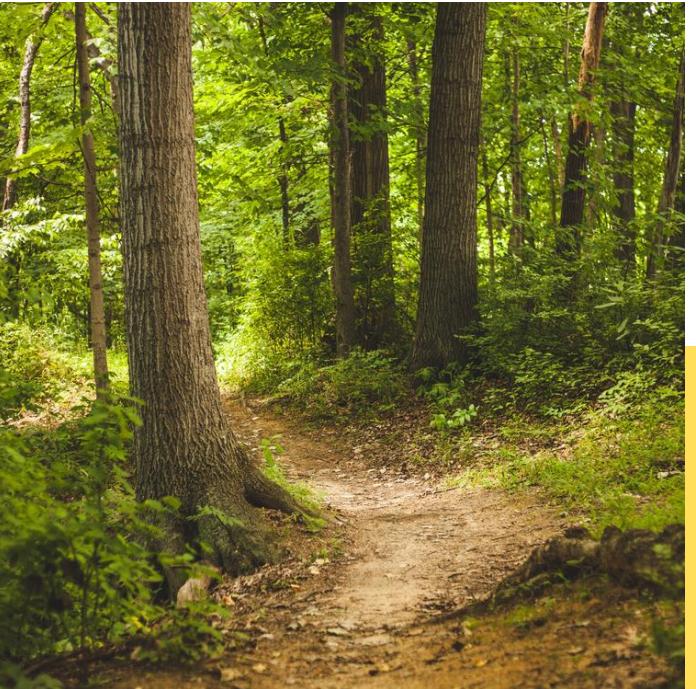
# What are Geographically Isolated Wetlands?

Wetlands with no surface water connection (at least part of the year)

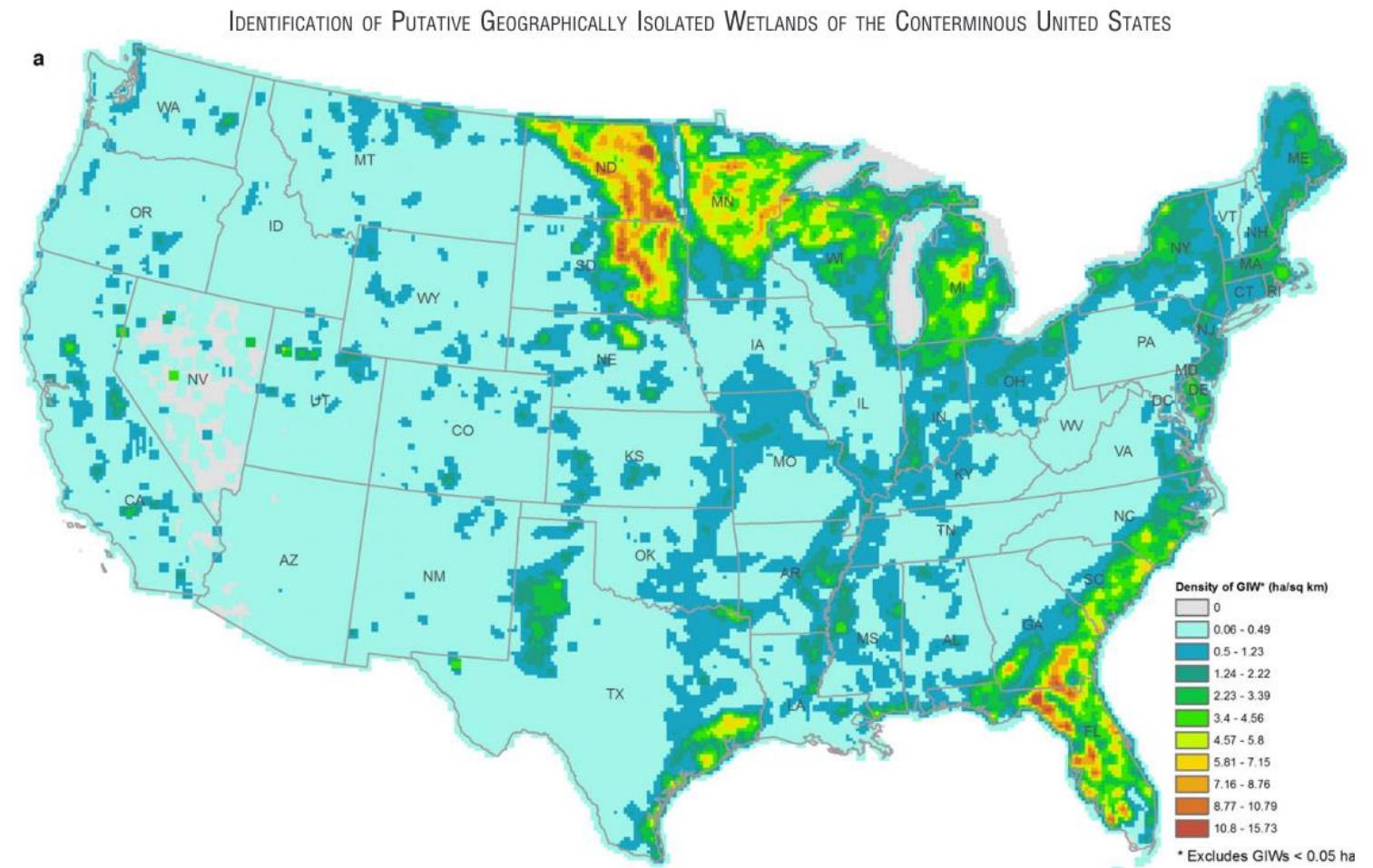
- Characterized by variable: hydrology, vegetation, and area



# Where are they found?



- Hardwood forest; Prairie; Pine Savanna; and Urban areas
- Continental Distribution with many names [ie. Carolina Bays, Prairie Potholes, Vernal Pools, etc.]





# What do we know about Birds in Isolated Wetlands?

- Evidence species richness is higher in wetlands than surrounding uplands.

(Barratt Heitmann et al. 2024, Riffell et al. 2006)

- Species richness is higher in urban wetlands compared to rural ones.

(McKinney and Paton 2009)

**But**, we don't know how these affect different functional groups of birds...

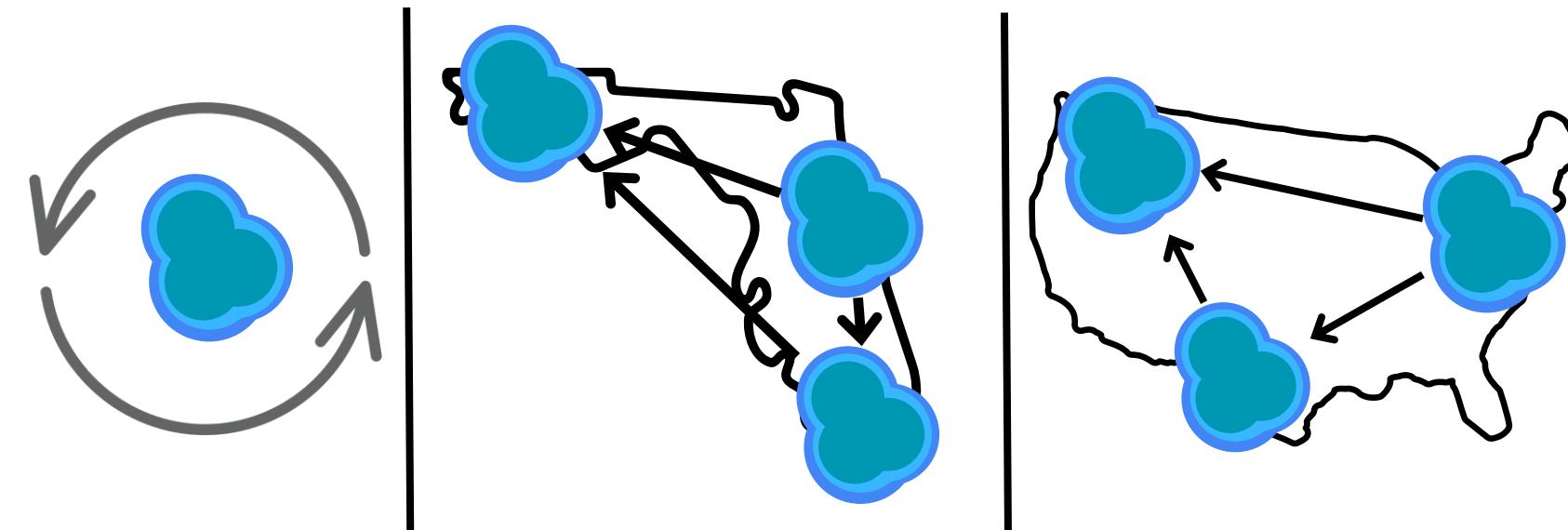
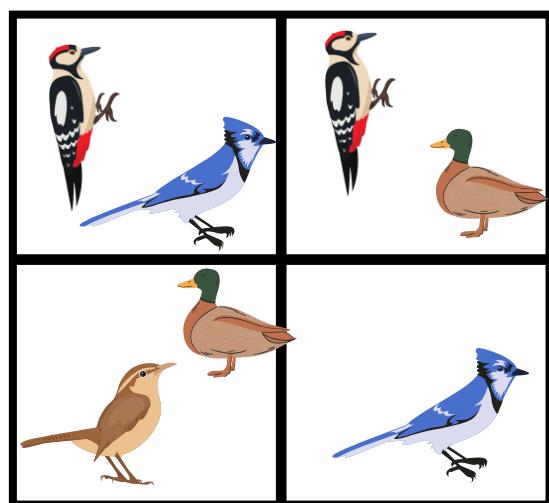
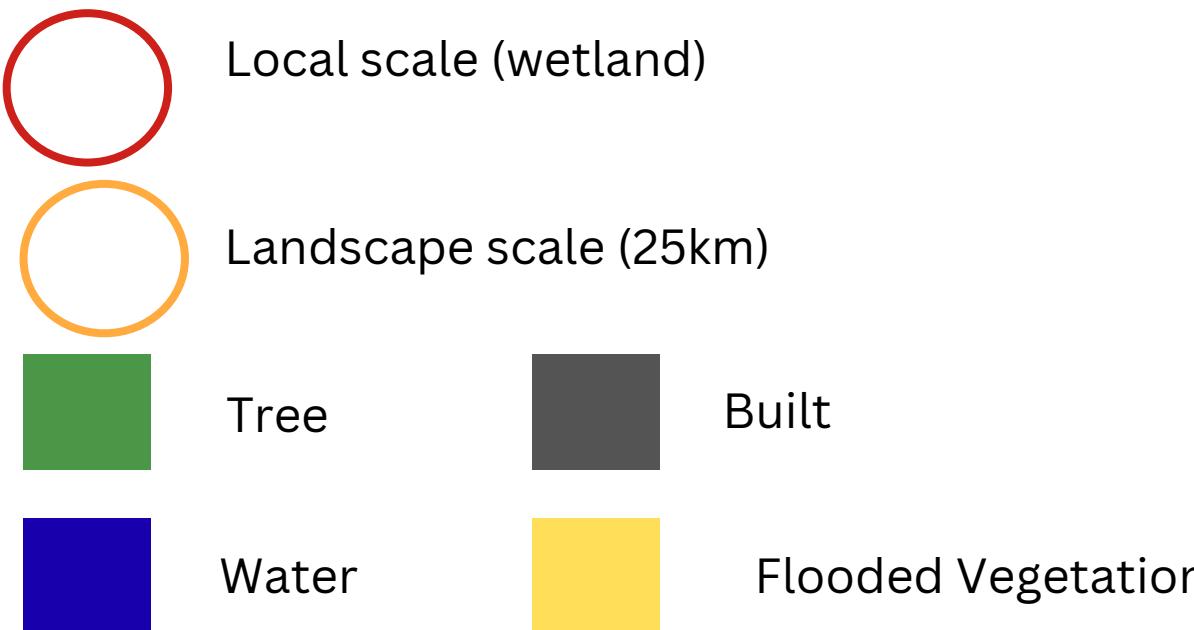
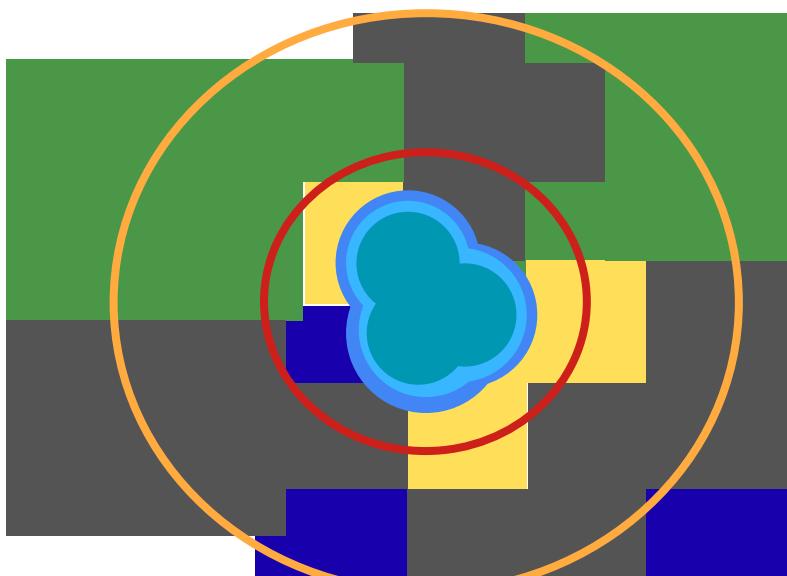
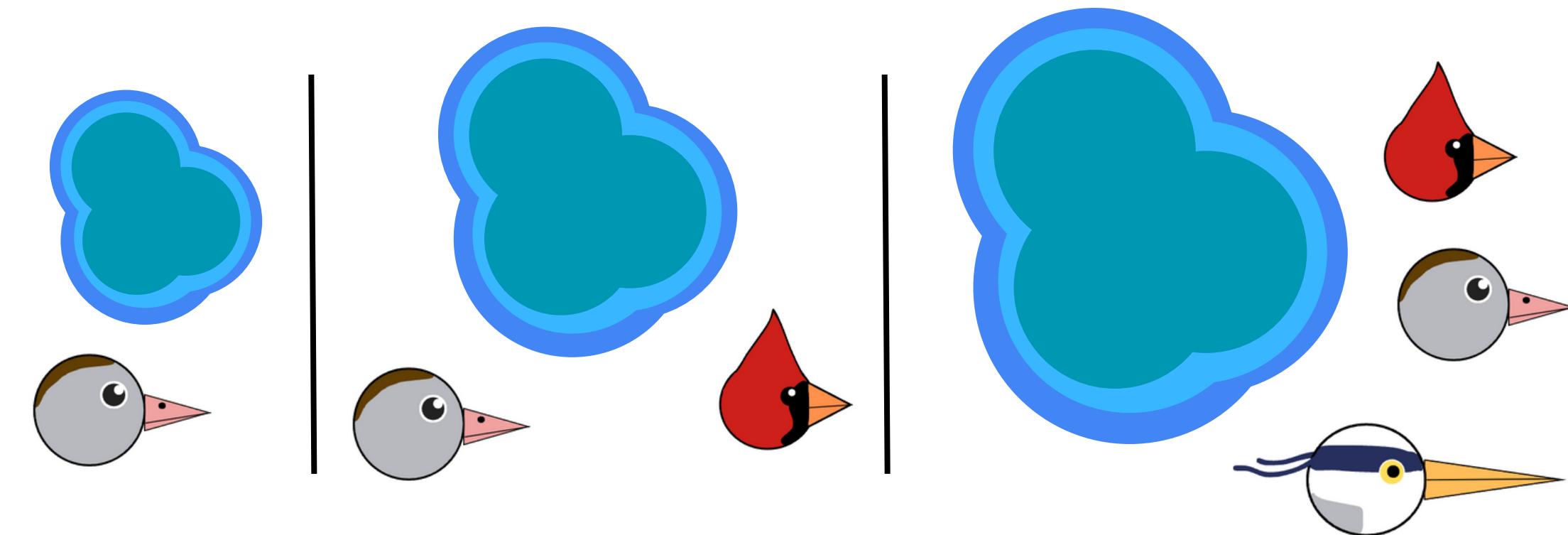
Or, if these signals are consistent spatially...

# What gaps are we trying to fill?

1. Does wetland area impact species richness?

2. How do local and landscape land cover impact species richness and functional groups in these systems?

3. Is there species turnover ( $\beta$ -diversity) between wetlands at multiple spatial scales?

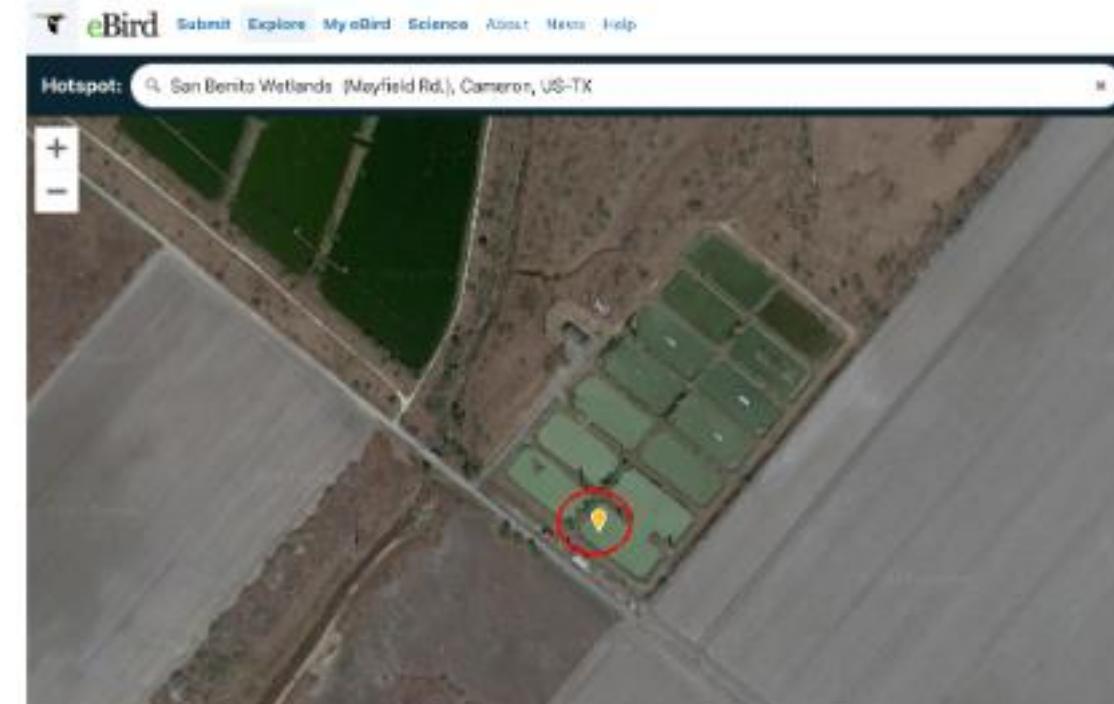


# Integrating 207 wetlands with eBird hotspots across the conterminous United States

eBird hotspot

San Benito Wetlands  
(L1673684)

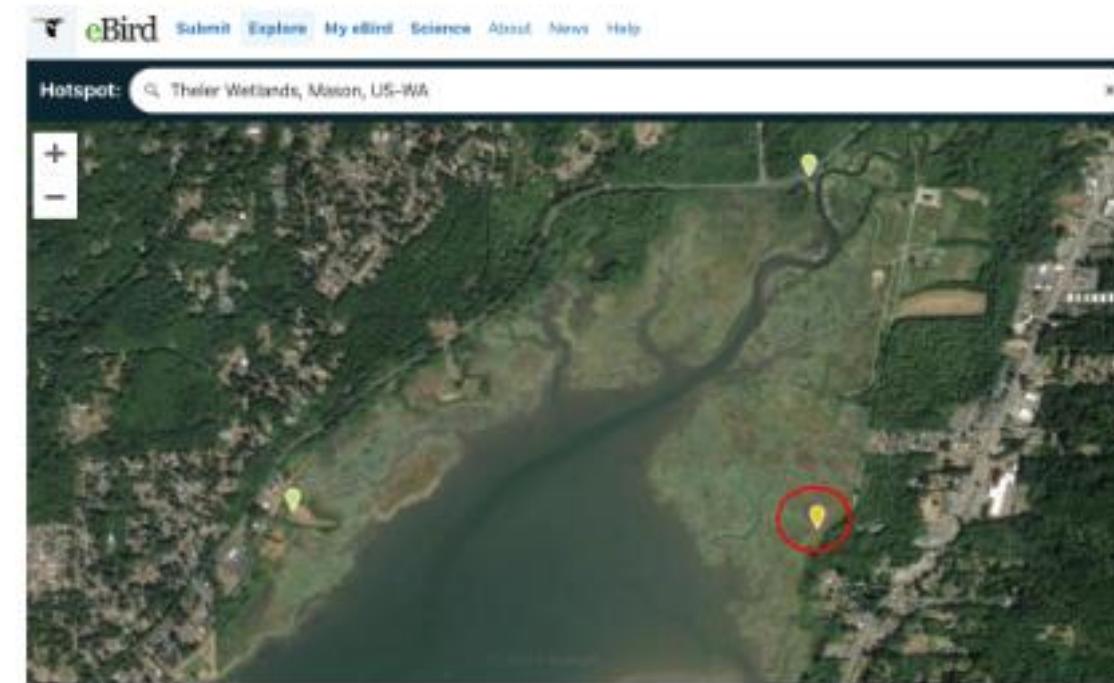
eBird hotspot screening

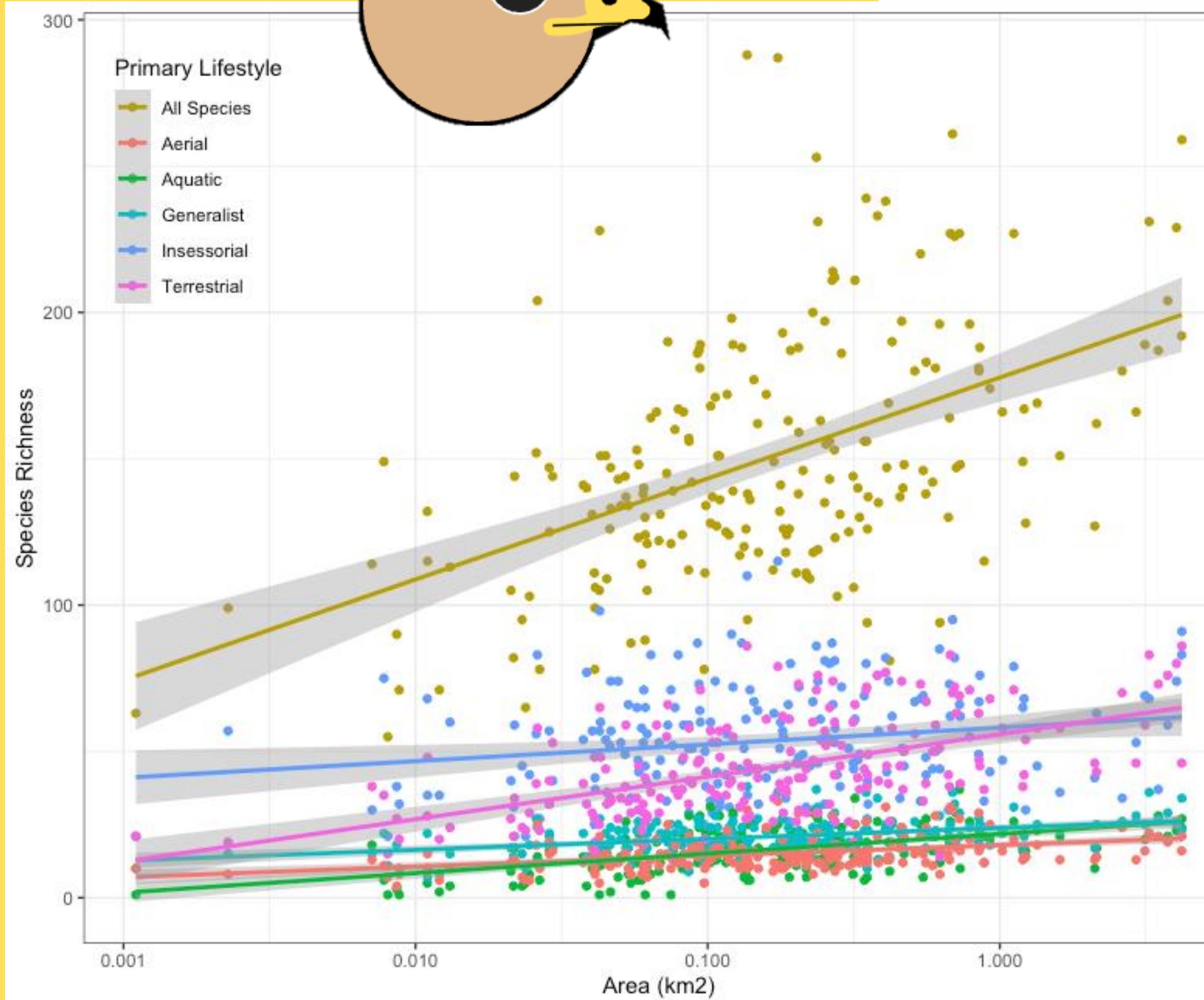
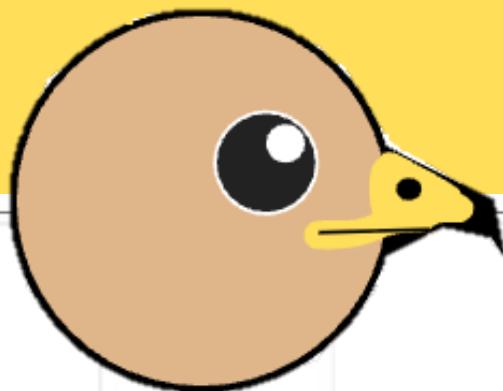


Wetland delineation in GeoJSON



Theler Wetlands  
(L250091)





# Objective 1: Species Richness Increases with Wetland Area

- We found that species richness increases as wetland area increases.
- This was most pronounced for Terrestrial and aquatic primary lifestyles.

Island Biogeography Theory wins again (!)

But, what about land cover impacts?

# Gathering land cover data from Google Earth Engine, and calculating species richness from eBird.

eBird Hotspot ID	Species Richness	Land Cover



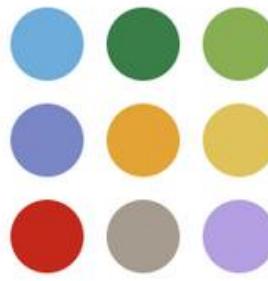
Generalized Linear Model (6 of them)

## Explore Dynamic World

Global 10m resolution near realtime land cover dataset, producing probabilities per pixel for 9 land types, useful for change-detection products and derivative maps.

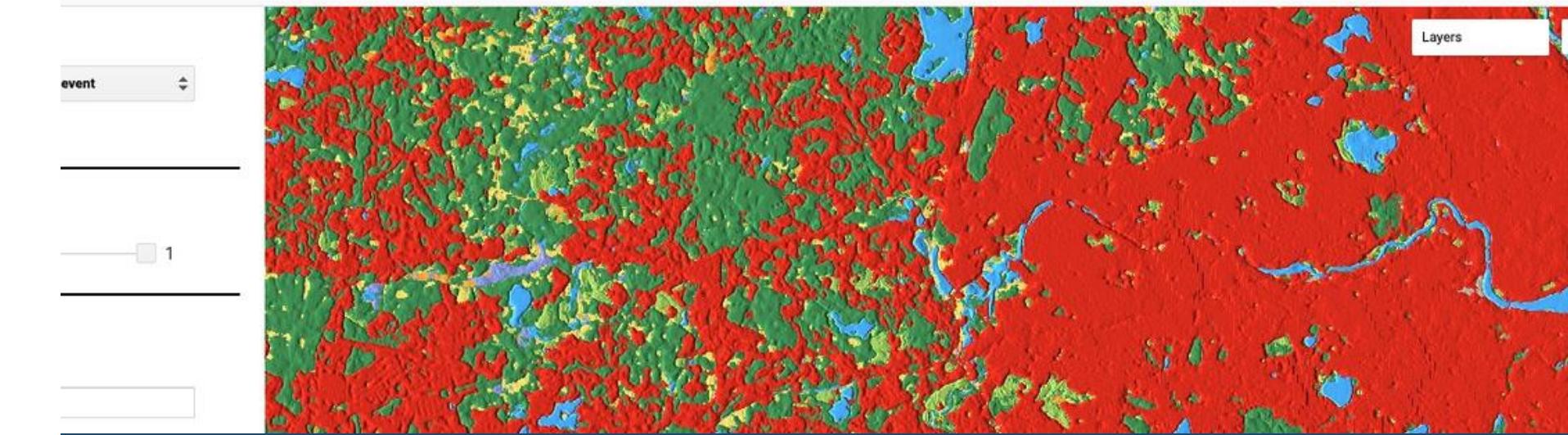
[HOW TO EXPLORE THE MAP](#)

[COLLAPSE](#)



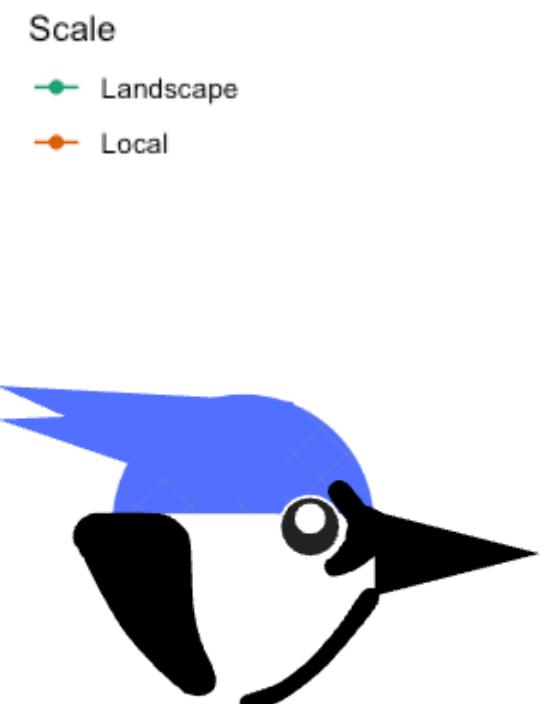
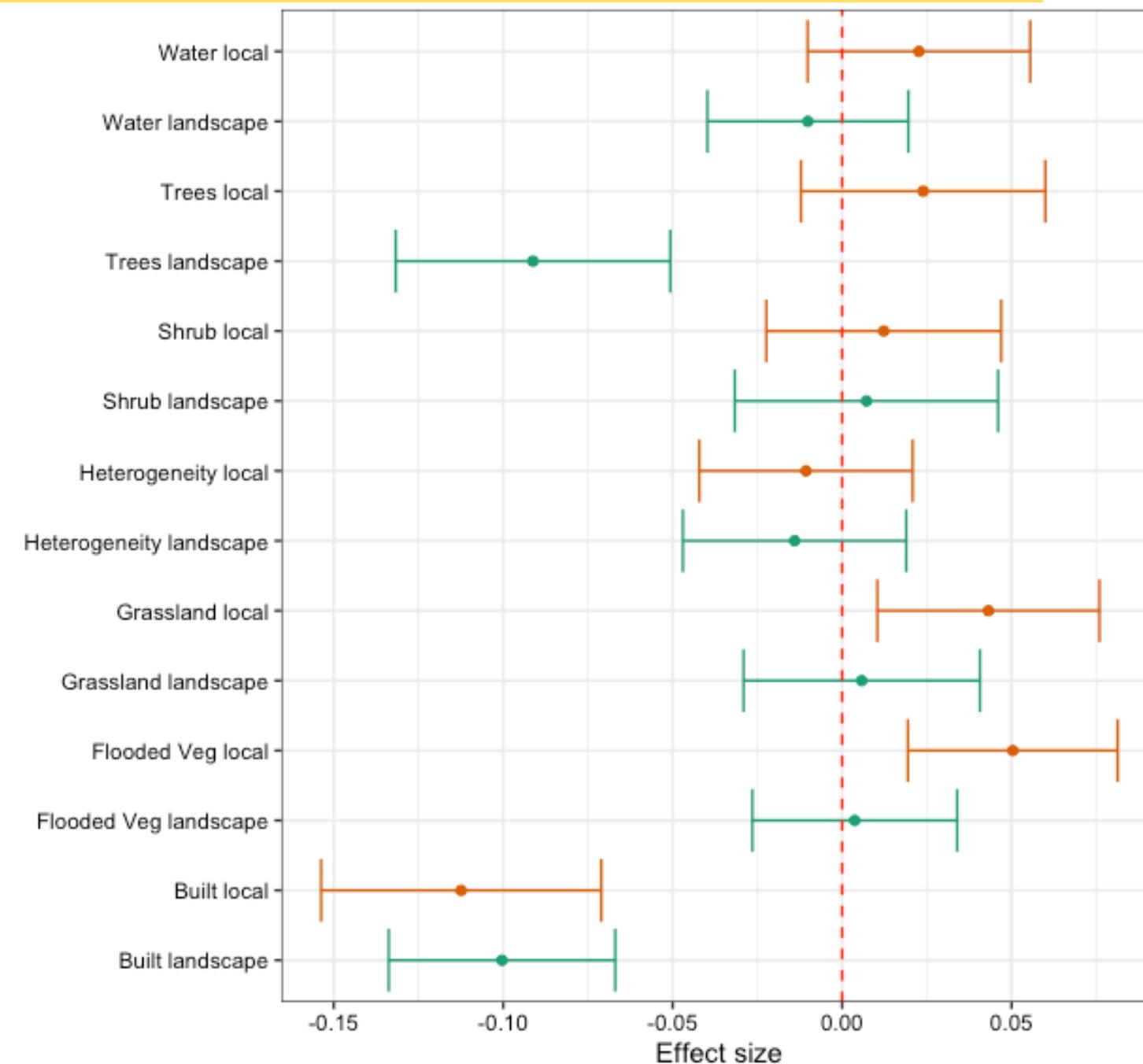
Search places

Earth E



Calculating overall species richness at each eBird hotspot, as well as species richness of 5 different functional groups (Tobias et al. 2022).

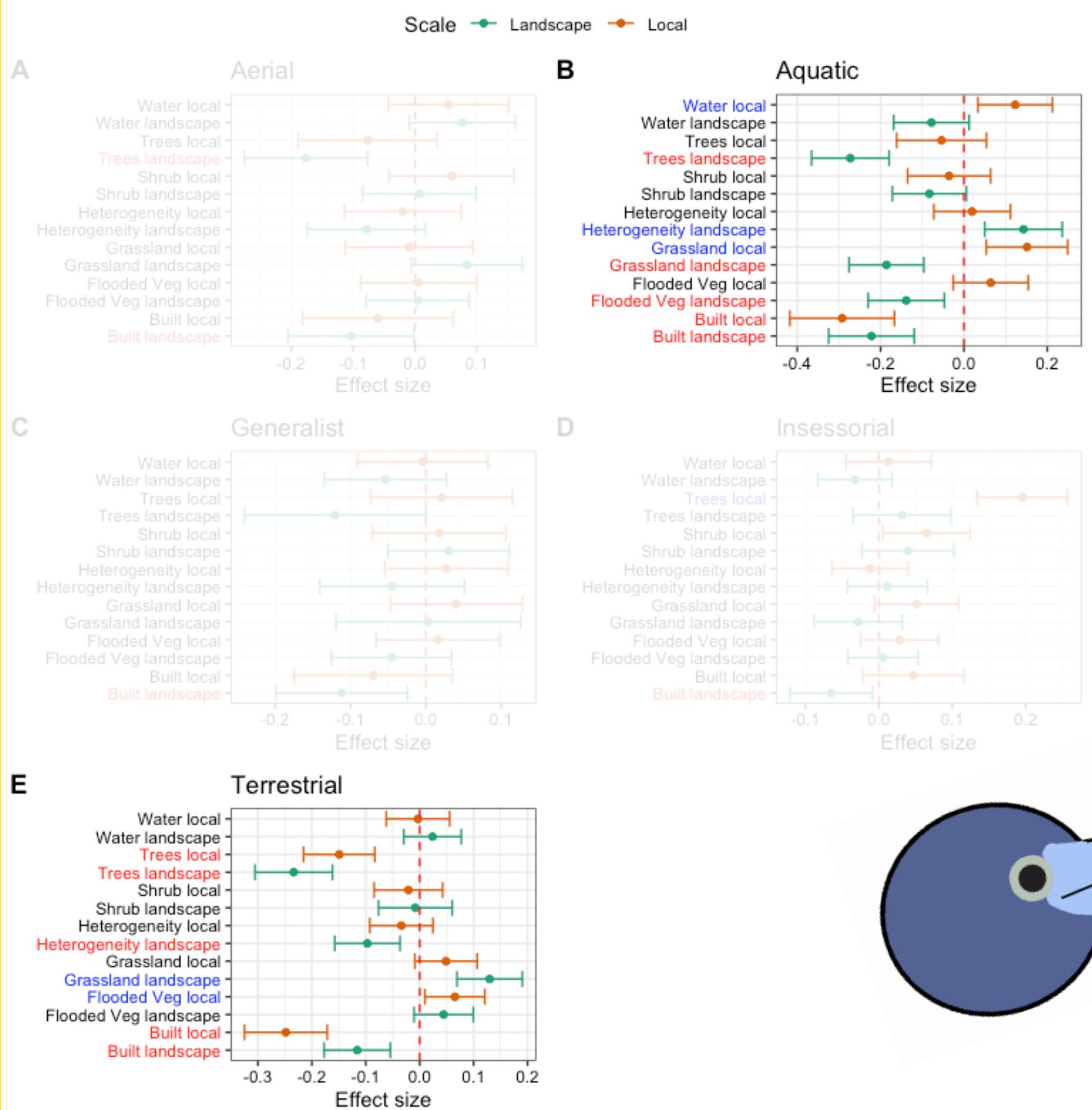
# Objective 2: Built area reduces species richness, flooded vegetation increases species richness.



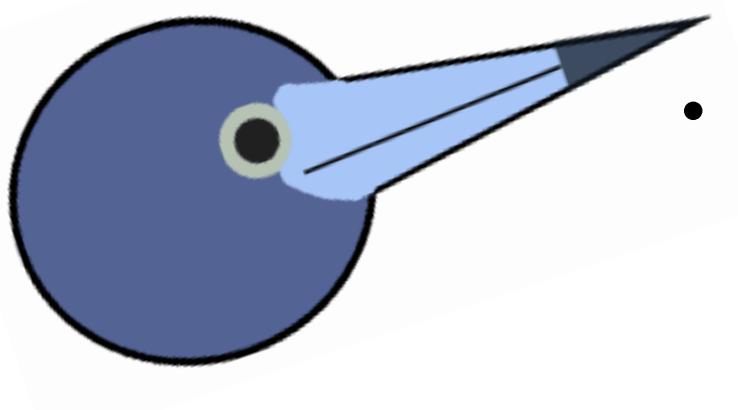
- Built land area reduces richness at multiple scales.
- Trees reduced species richness, likely due to environmental filtering in the Temperate Forests of the Northeast.
- Flooded vegetation and grass cover promote richness at the local scale.

But, what about the functional group richness?

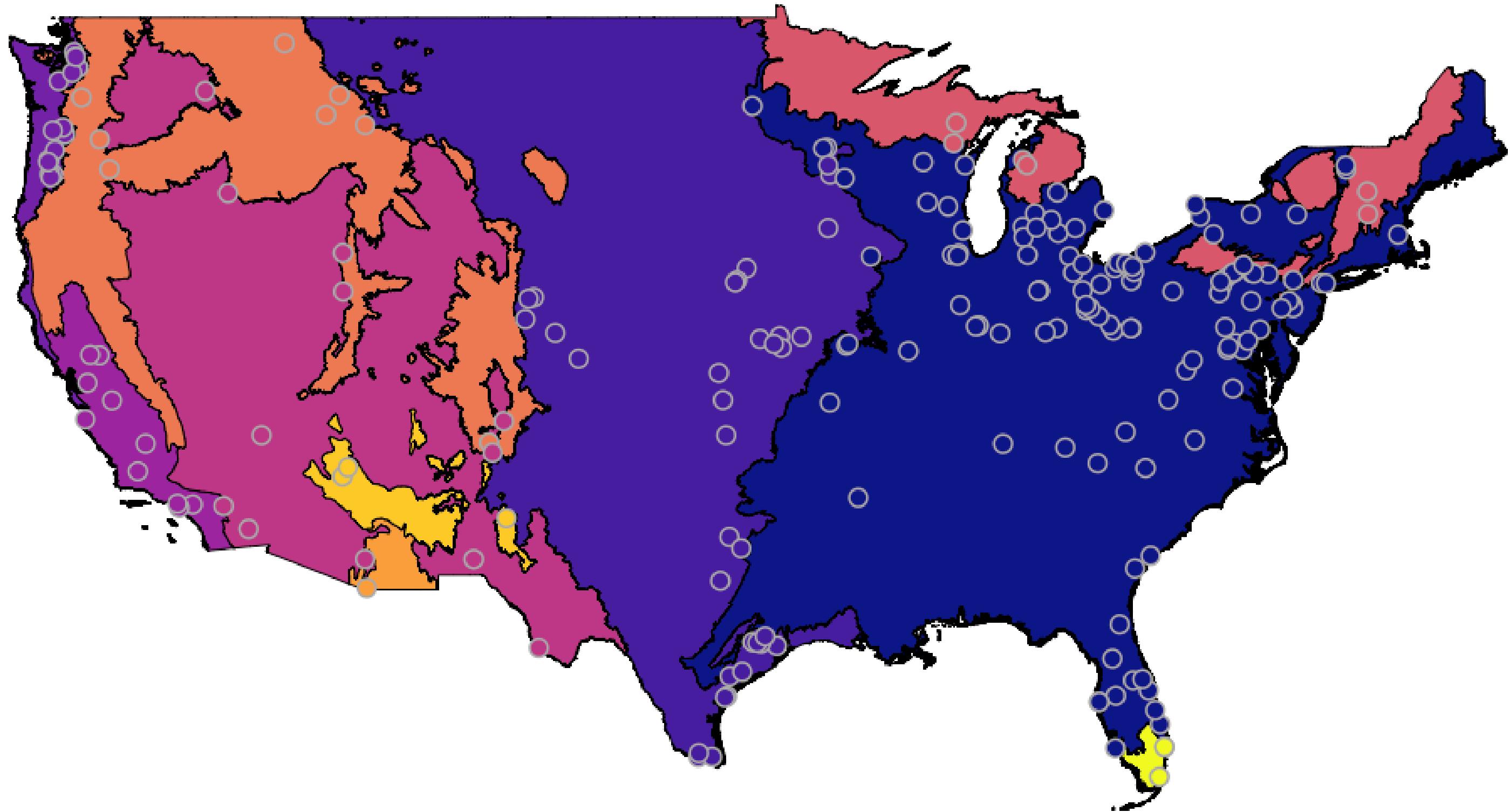
# Objective 2 (cont.): Land cover impacts functional group richness differently



- All species respond negatively to built land area, at multiple scales.
- Aquatic species richness responds positively to water and grassland cover locally, heterogeneity in landscape.
- Terrestrial species richness positively associated with grassland and flooded vegetation cover.



Tell me about the species turnover!



- EASTERN TEMPERATE FORESTS
- GREAT PLAINS
- MARINE WEST COAST FOREST
- MEDITERRANEAN CALIFORNIA

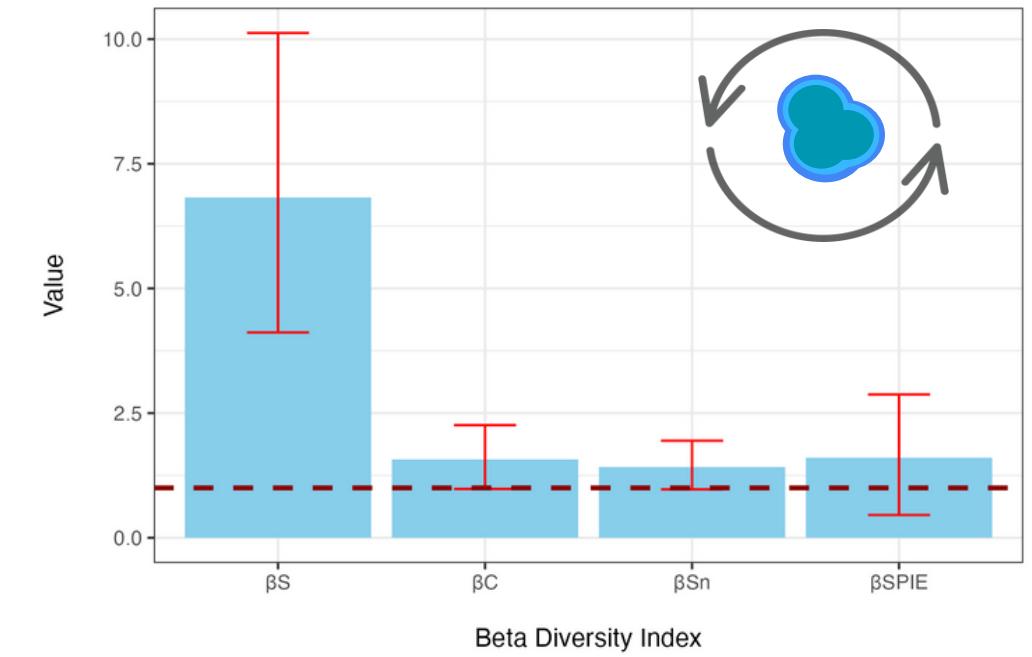
- NORTH AMERICAN DESERTS
- NORTHERN FORESTS
- NORTHWESTERN FORESTED MOUNTAINS
- SOUTHERN SEMIARID HIGHLANDS

- TEMPERATE SIERRAS
- TROPICAL WET FORESTS

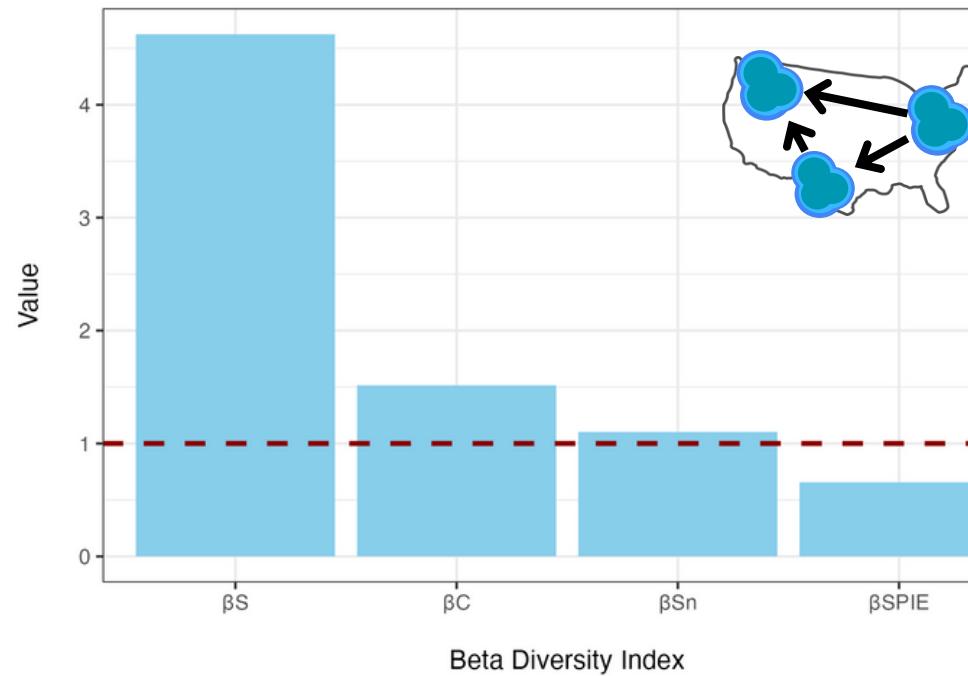
## Map of all $n=207$ isolated wetlands by EPA Level I ecoregion

Are there changes in the bird community within wetlands, between them, or between ecoregions?

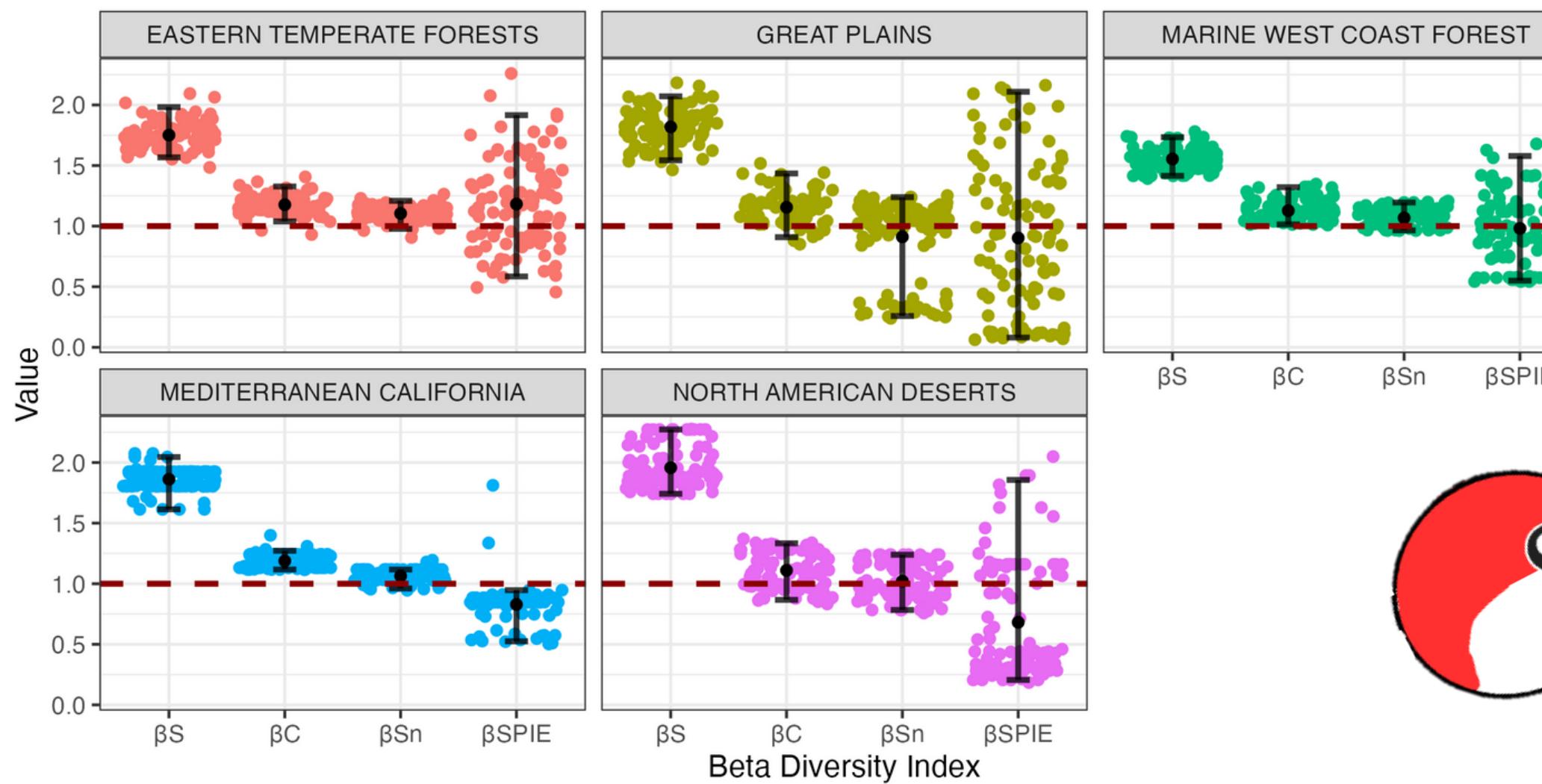
## Wetland



## Continental

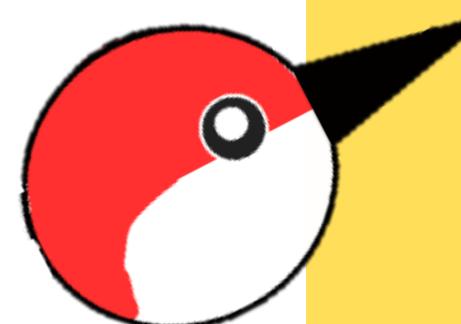


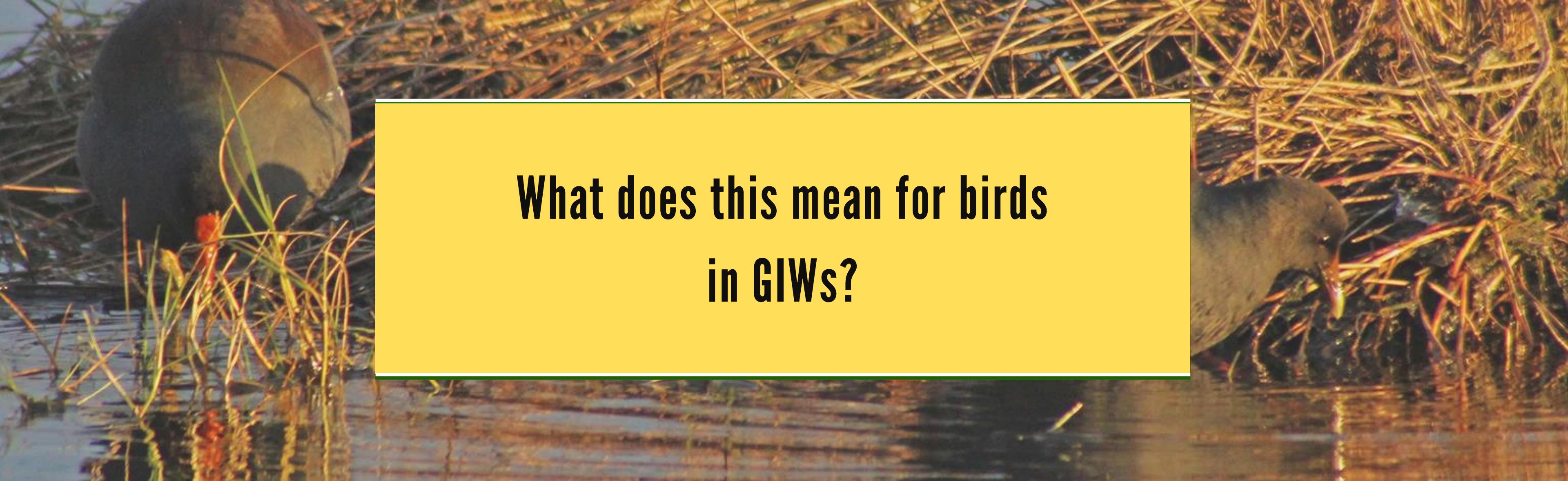
## Ecoregion



# Objective 3: $\beta$ -diversity is consistent across spatial scales

- $\beta S$  values were quite high across all sampling scales, and  $\beta C$  values were generally low.
- Species turnover ( $\beta$ ) is not due to aggregation changes, but rather random sampling (i.e., changes in abundance of species and in the identify of rare species).





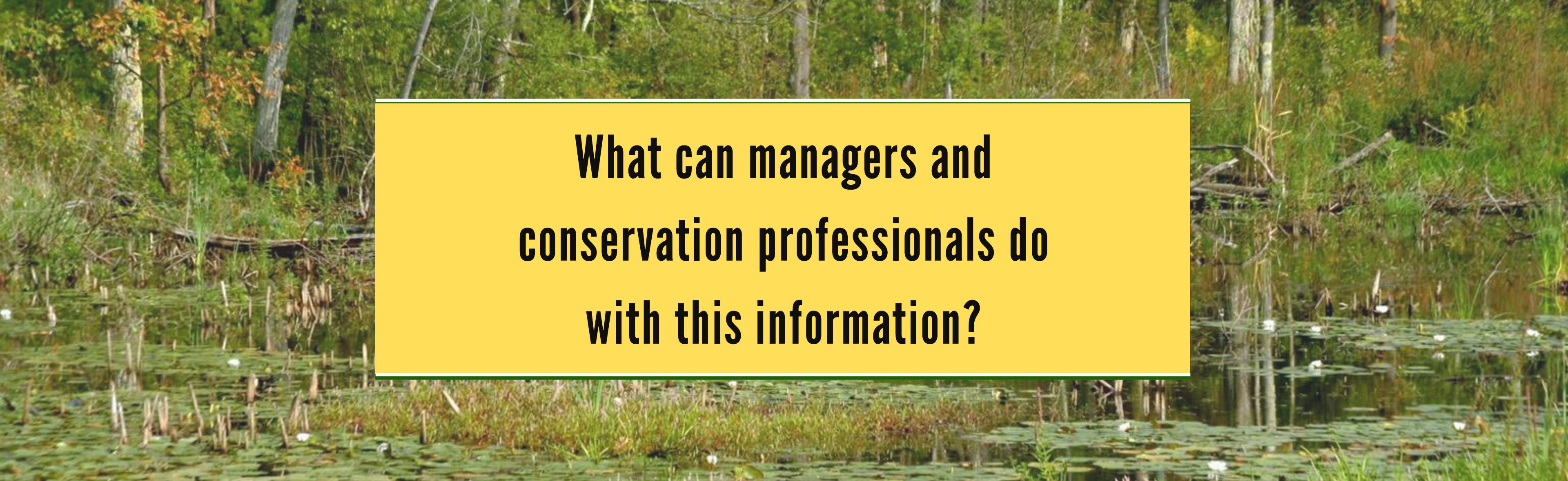
## What does this mean for birds in GIWs?

Terrestrial and aquatic species richness drive the species area relationship

Larger wetlands likely visited by a greater number of larger-bodied species compared to relatively smaller insessorial and aerial species.

Landscape variables are responsible for negative trends in richness, local variables responsible for positive predictors of species richness.

GIWs across the continent have low species turnover due to aggregation, but have very high diversity



# **What can managers and conservation professionals do with this information?**

Prioritize preservation/restoration/creation of larger wetlands

Incorporate flooded vegetation in created wetlands and restoration of natural wetlands.

Identify wetlands for conservation across their continental distribution, for high bird biodiversity value



# Thanks to everyone who contributes to eBird.

Special thanks to my collaborators **Brittany Mason** and **Corey T. Callaghan**

A photograph of a wetland area with many green lily pads on the water. Several birds are visible: a mallard duck, a green-winged teal, a blue-winged teal, and a green heron. A large blue dragonfly is also present on a lily pad. The background shows a shoreline with trees and hills under a clear sky.

**Diversity and Distributions**  
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RESEARCH ARTICLE | [Open Access](#) |

**Land Cover and Area Influence Bird Biodiversity in Geographically Isolated Wetlands**

Jackson Barratt Heitmann , Brittany M. Mason, Corey T. Callaghan

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**Funding:** This work was supported by College of Liberal Arts and Sciences, University of Florida.

**Questions:** [j.barratheitman@ufl.edu](mailto:j.barratheitman@ufl.edu)

**Fun Facts:**

Spark bird was the Red-bellied Woodpecker.

Favorite bands are Death Cab for Cutie, Vampire Weekend, and all things Bob.

Will talk all things running, cycling, and Wingspan.