Mapping watershed degree of invasion across the continental U.S.

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What is EnviroAtlas?

An interactive online decision support tool giving users the ability to view, analyze, and download geospatial data and other resources; designed to inform decision-making, education, and additional research.

EnviroAtlas includes over 160 national scale data layers:

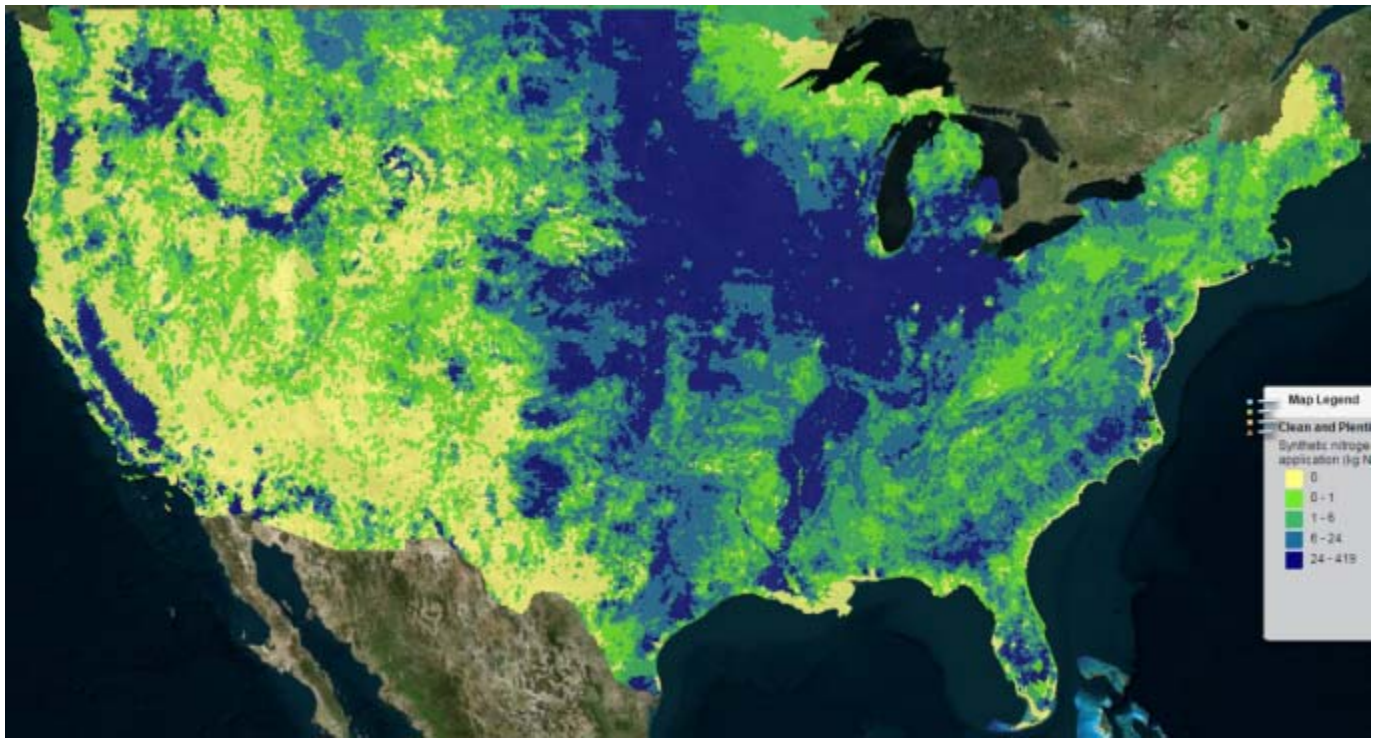
- Metrics reflecting ecosystem services provisioning and stressors
- Biodiversity conservation
- Boundaries, land cover, soils, hydrography, wetlands, demographics, roads)

https://www.epa.gov/enviroatlas

Developed through cooperative effort amongst multiple Federal agencies and other organizations.

Version 1 Released May 2014

Example Data Layer: Clean and Plentiful Water



- 160 + layers provide coverage for conterminous US; summarized by ~90,000 drainage basins (12-digit HUCs).
- Several indicators quantifying ecosystem services and benefits but no data regarding invasive species

Objectives:

1. Map freshwater aquatic exotic species richness of watersheds across the CONUS to provide data layer for EnviroAtlas

2. Determine if recreational demand is a better predictor than population of aquatic exotic species richness
    - ➢ Recreation demand is a mechanistic link

Methods:

A. Database Development

1. Downloaded freshwater aquatic exotic species data from the following sources :
    - USGS BISON
    - USGS NAS
    - EddMaps (Early Detection and Distribution Mapping System)

2. Cleaned data in R : removed centroids and duplicate occurrence records; extracted relevant attributes

3. Georeferenced point data by HUC unit in ArcGIS

4. Integrated data using MySQL

B. Use Poisson Regression to compare effects of population and recreational demand on richness

Can now quickly summarize exotic richness by HUC watershed boundary

Exotic Aquatic Plants Database

- All exotic plants listed in USDA Plants inhabiting aquatic freshwater habitats (n=67)
- total of 245,507 records

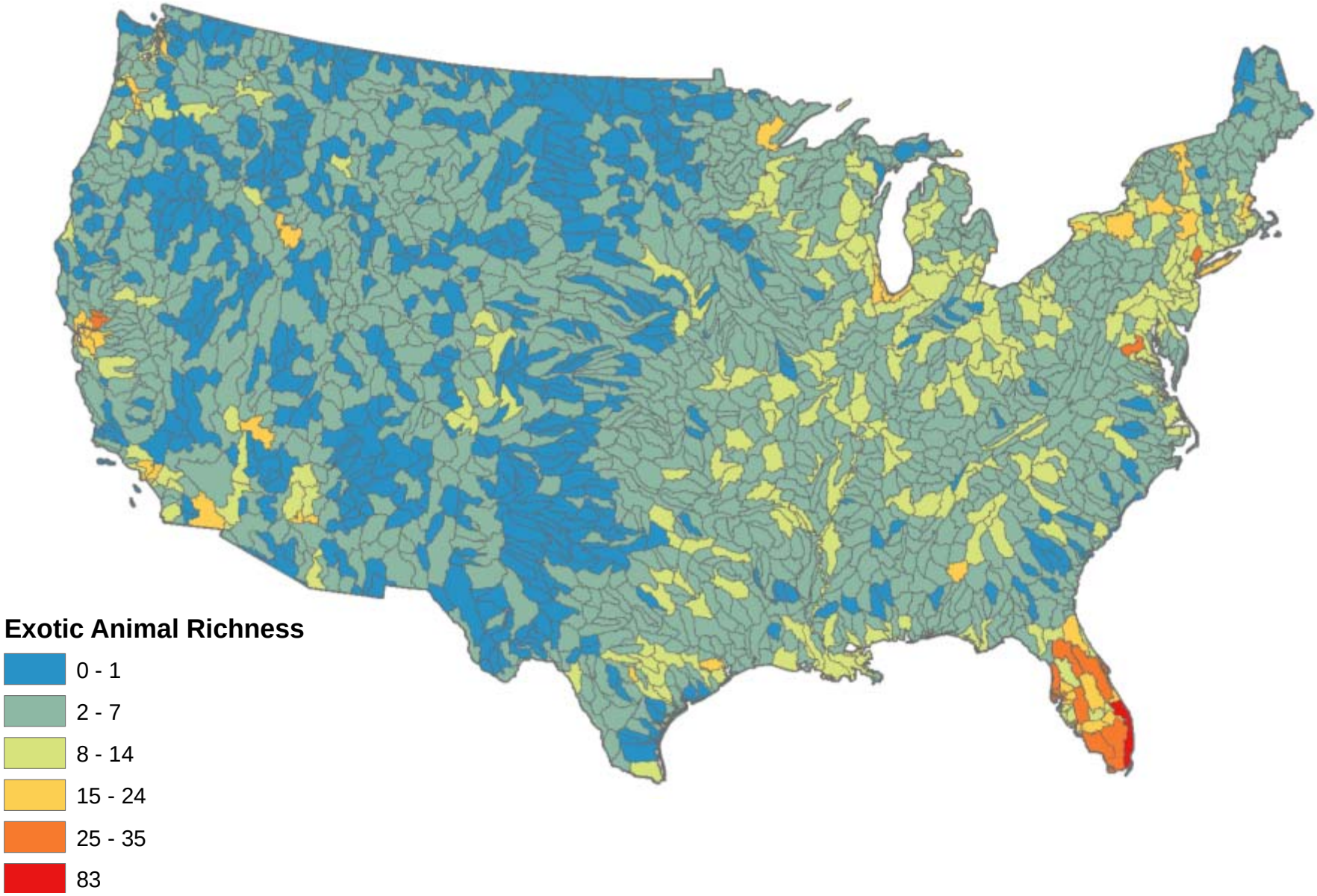
Exotic Aquatic Animals Database

- All exotic freshwater aquatic animal species listed by USGS NAS (n=287)
- total of 156,269 records

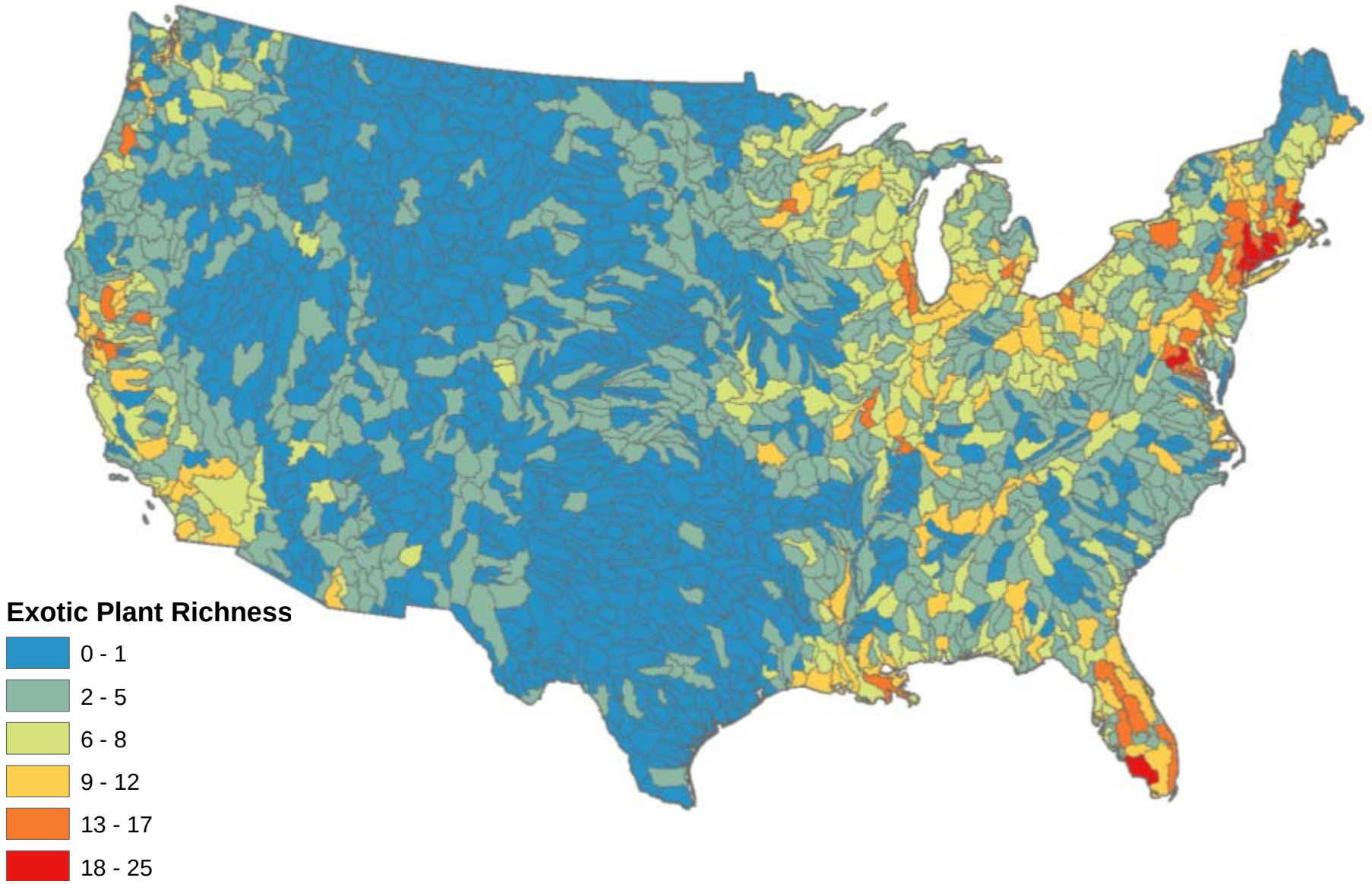
Connecticut River Watershed

Image adapted from: http://nh.water.usgs.gov/project/ct_atlas/water_wsheds_huc.htm

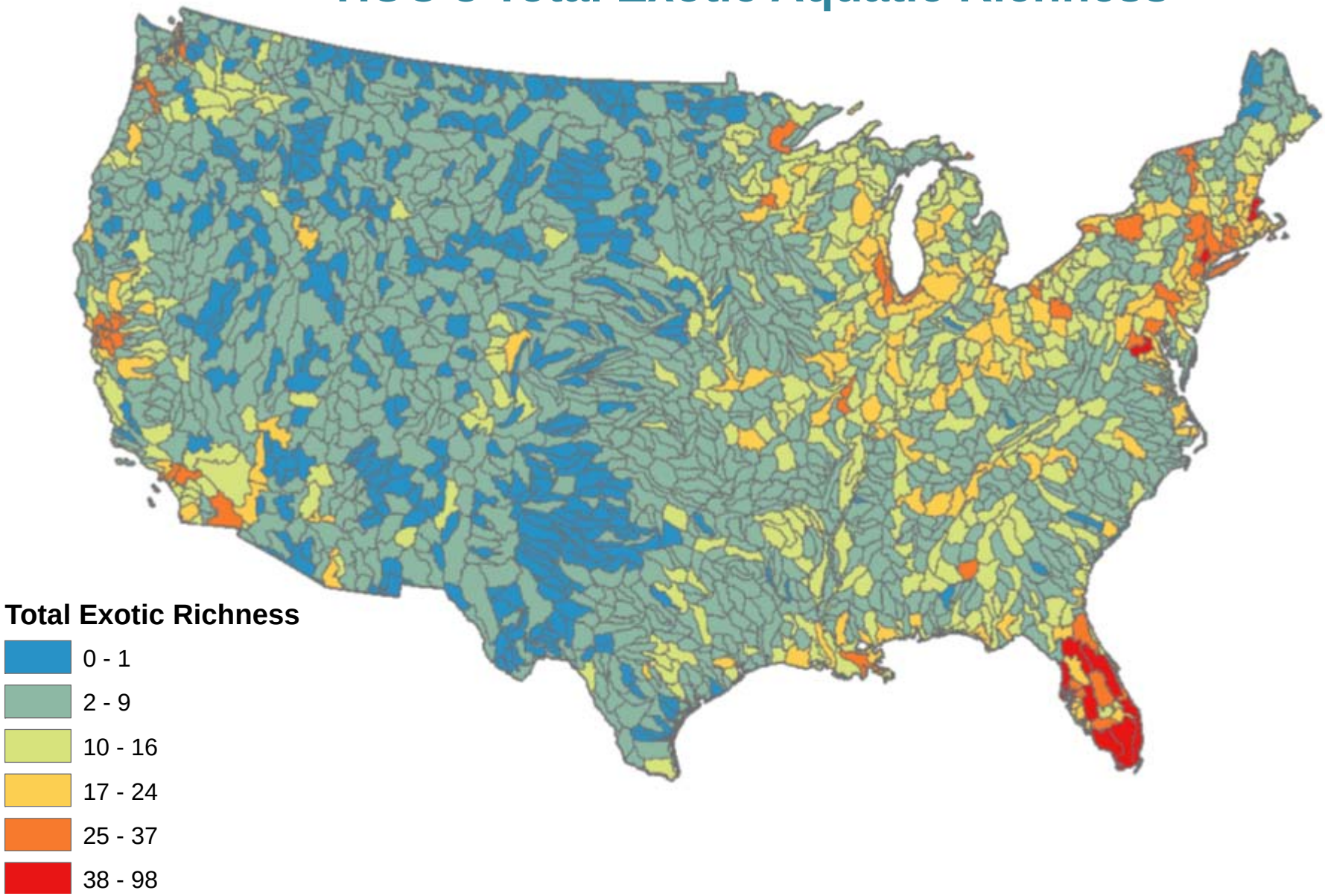
HUC 8 Exotic Animal Richness



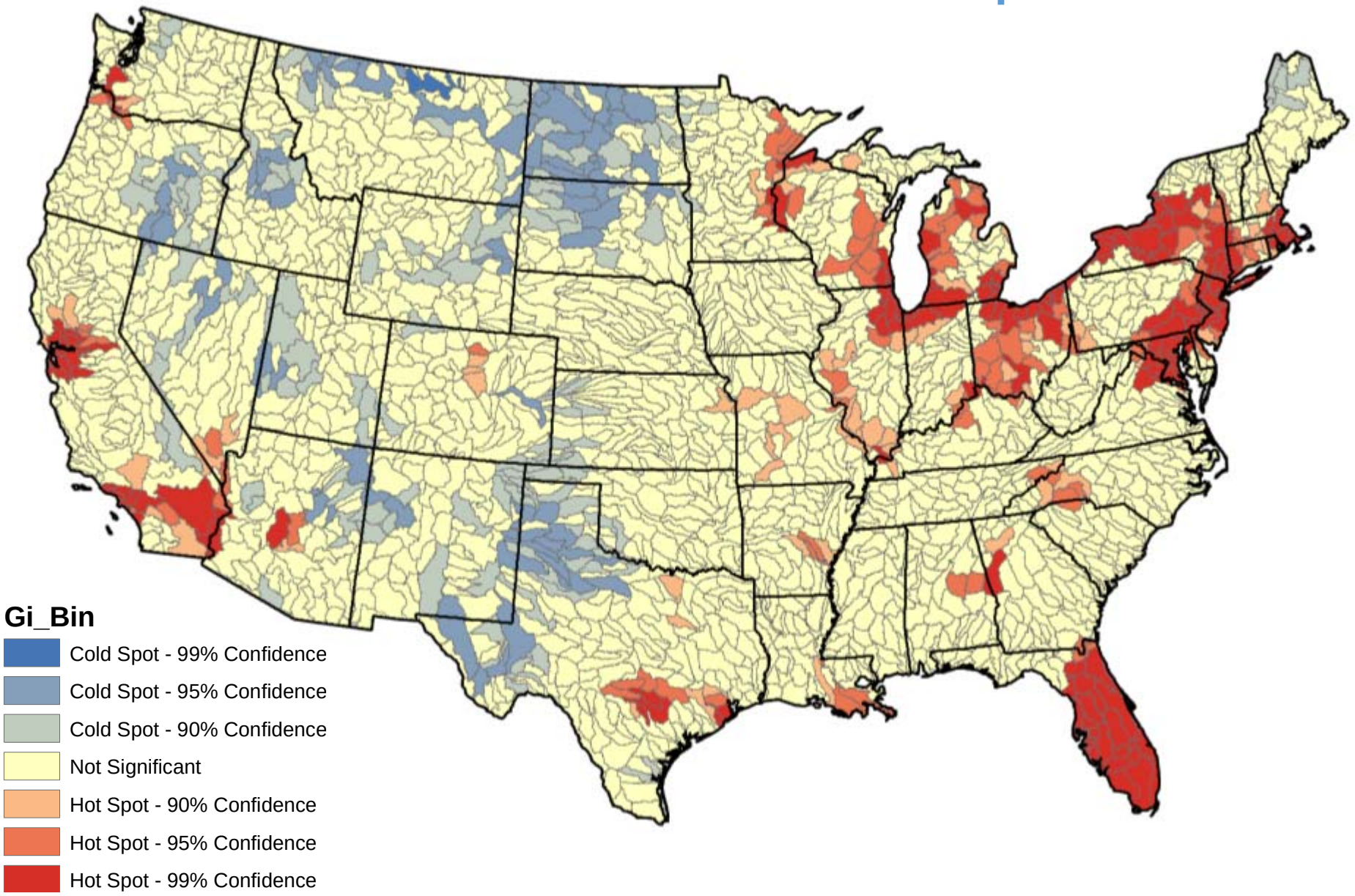
HUC 8 Exotic Aquatic Plant Richness



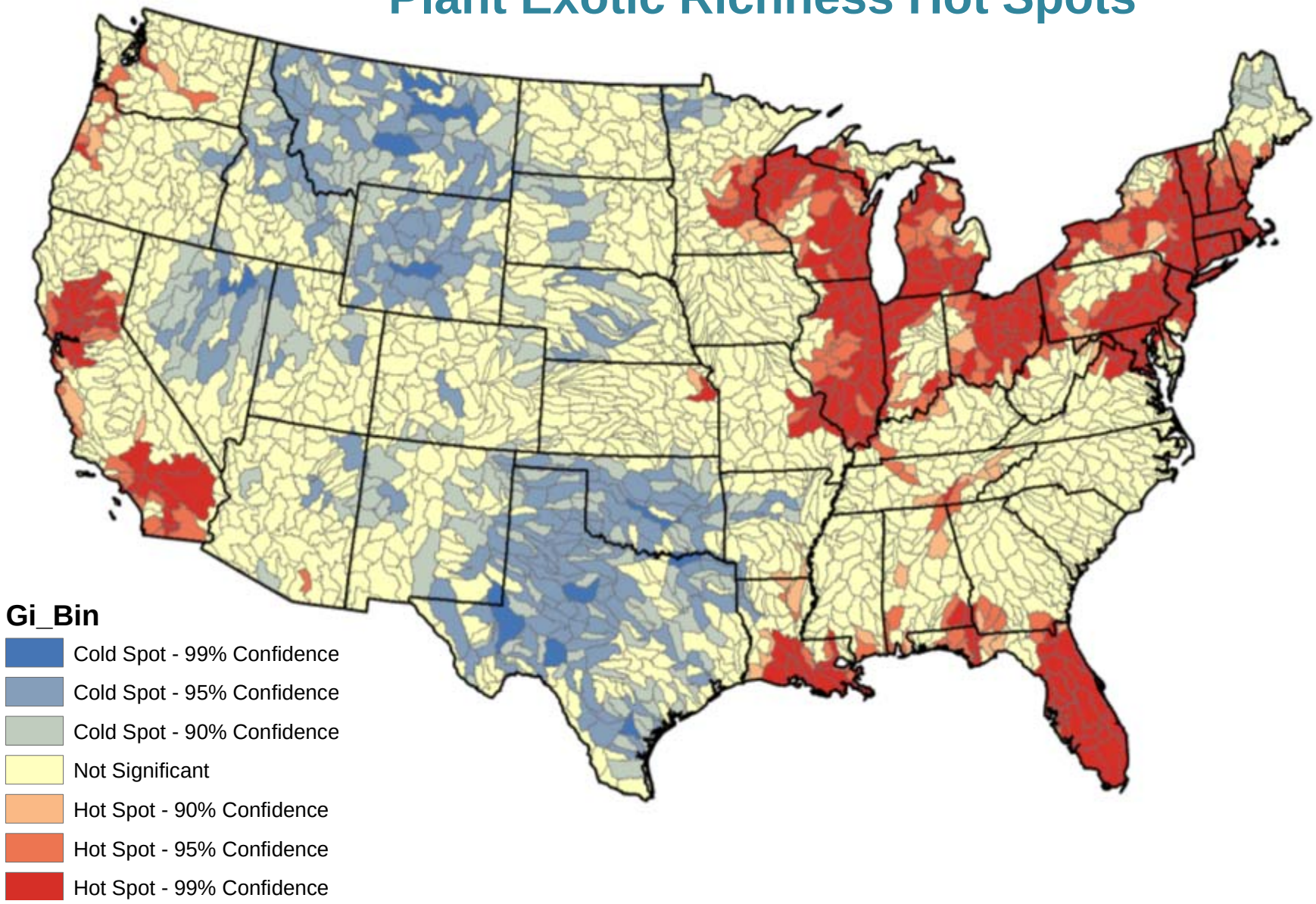
HUC 8 Total Exotic Aquatic Richness



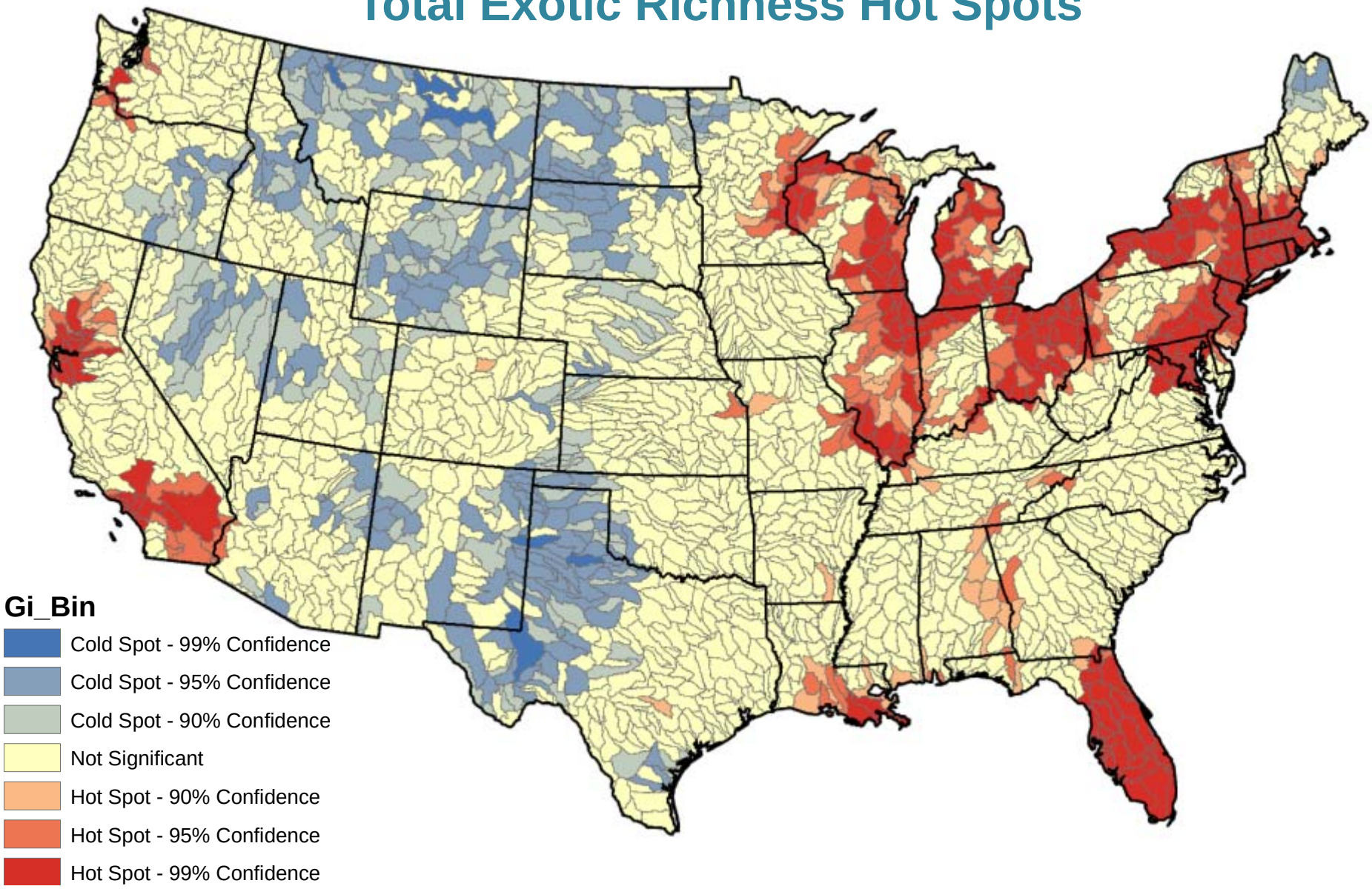
Animal Exotic Richness Hot Spots



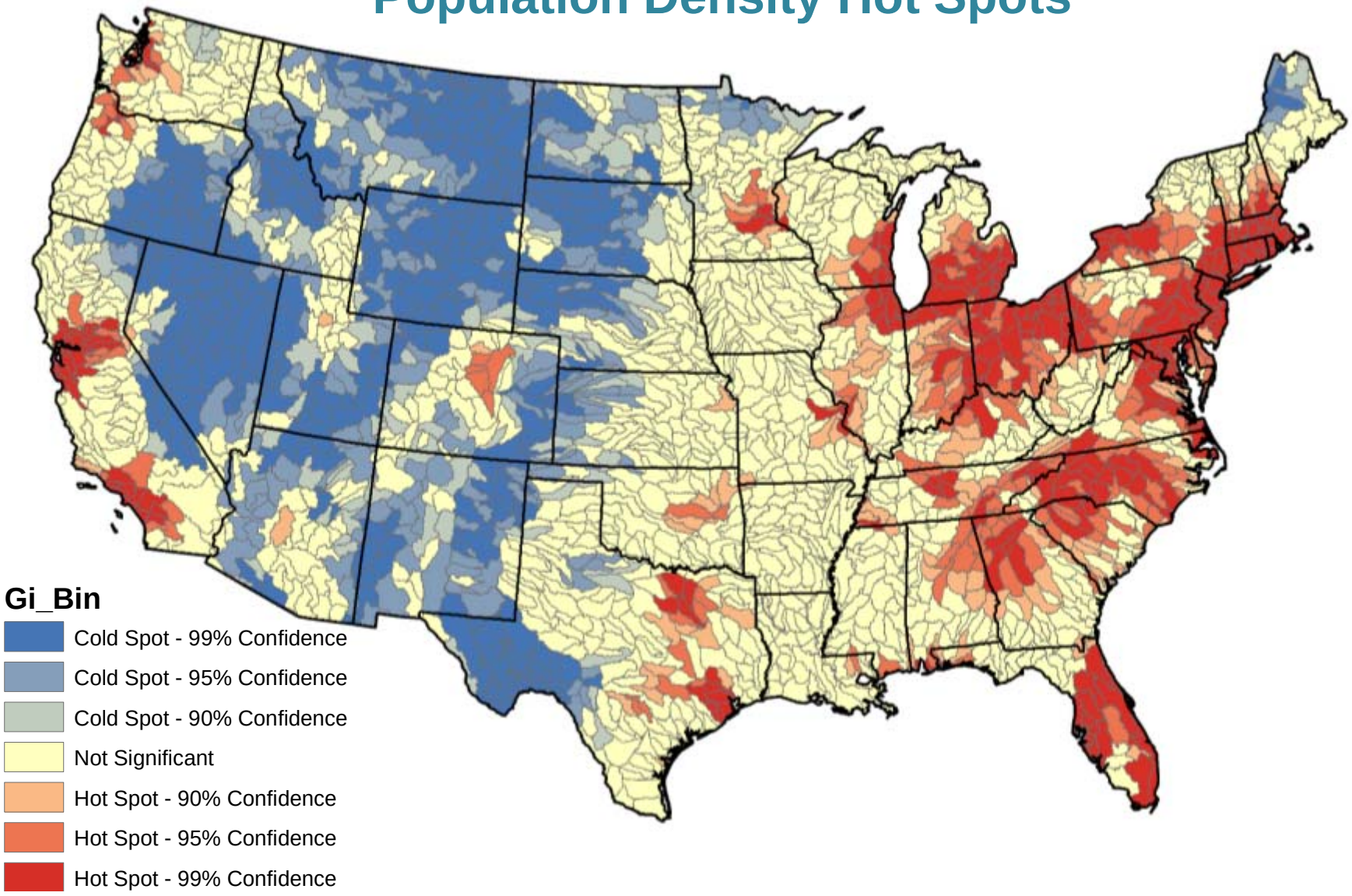
Plant Exotic Richness Hot Spots



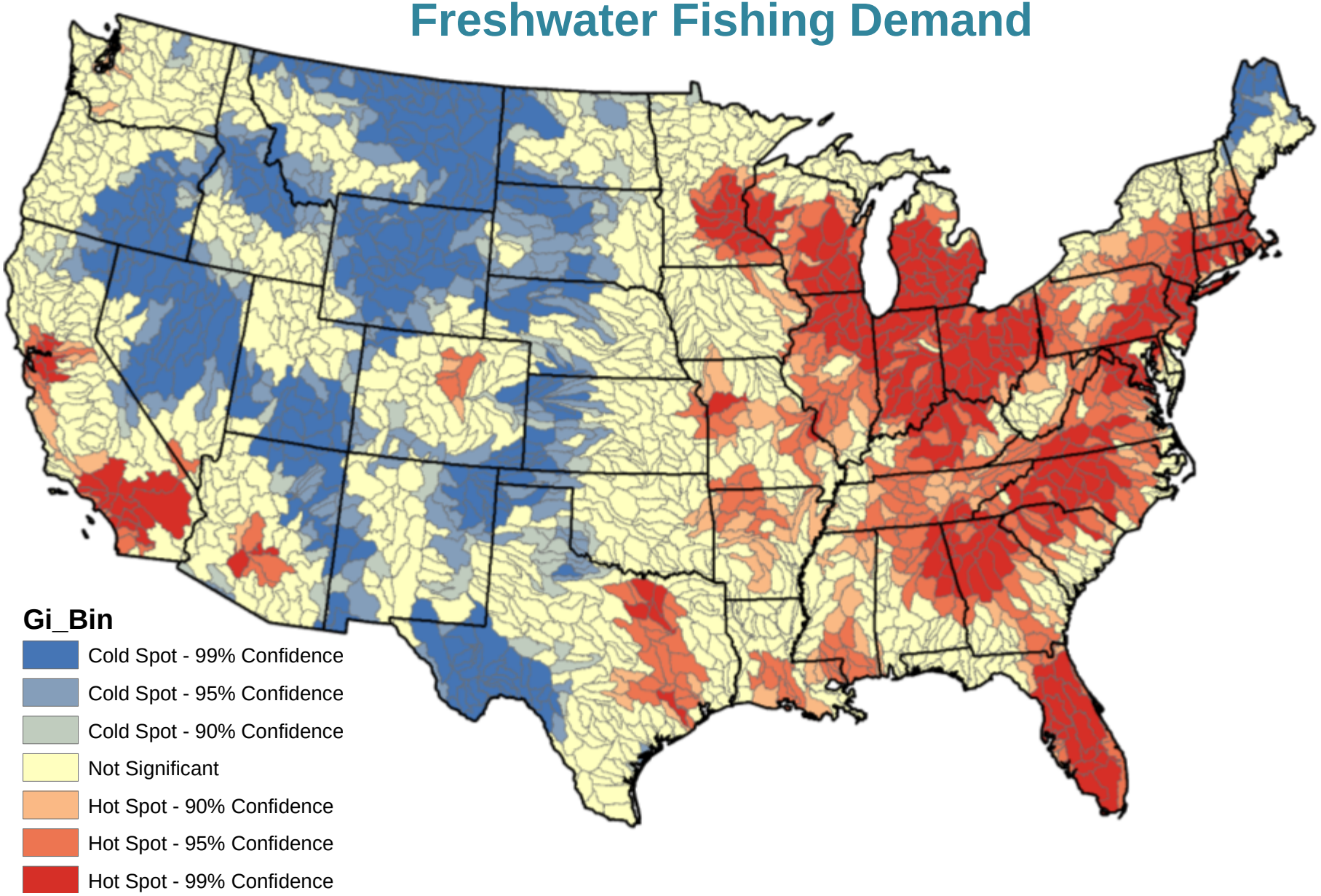
Total Exotic Richness Hot Spots

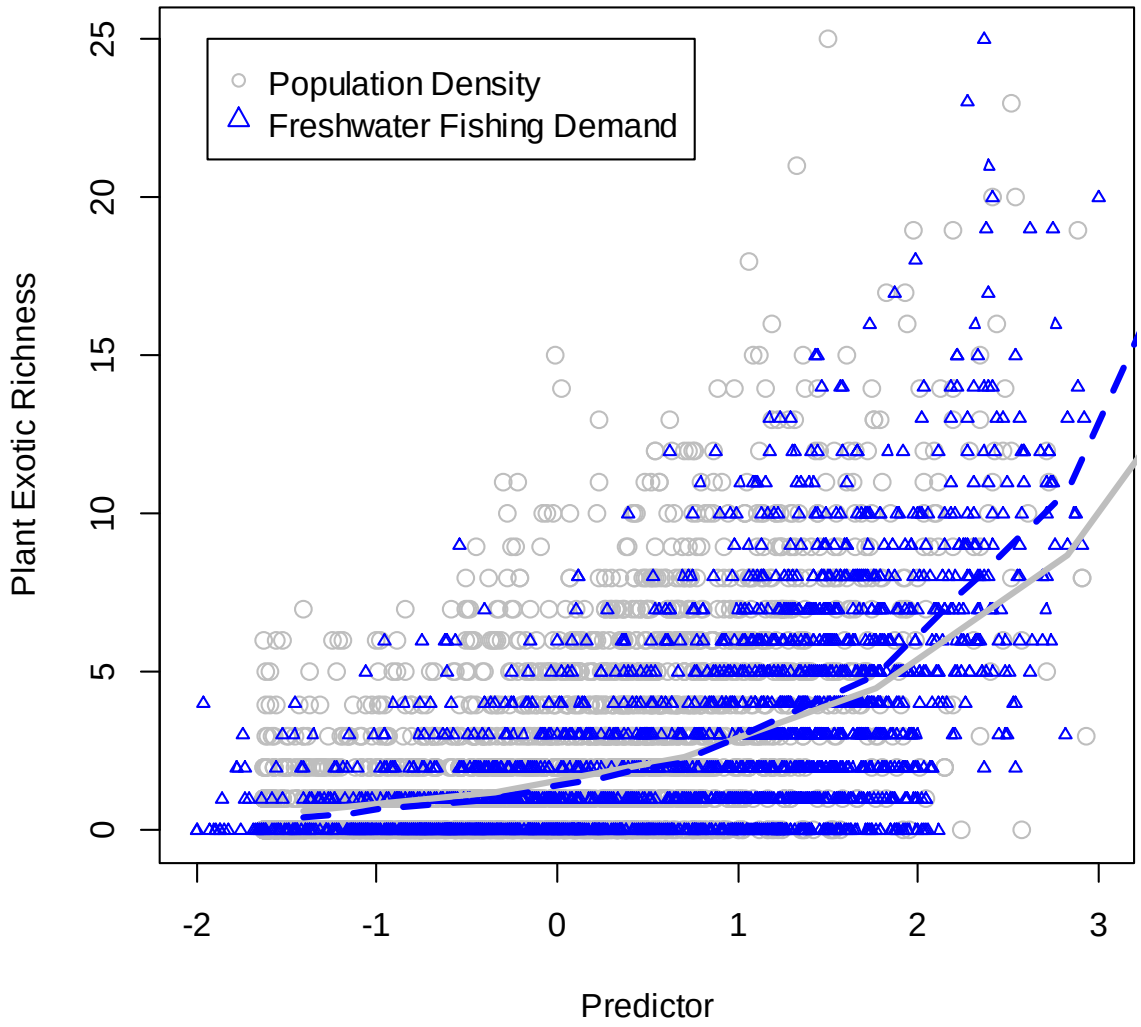


Population Density Hot Spots



Freshwater Fishing Demand



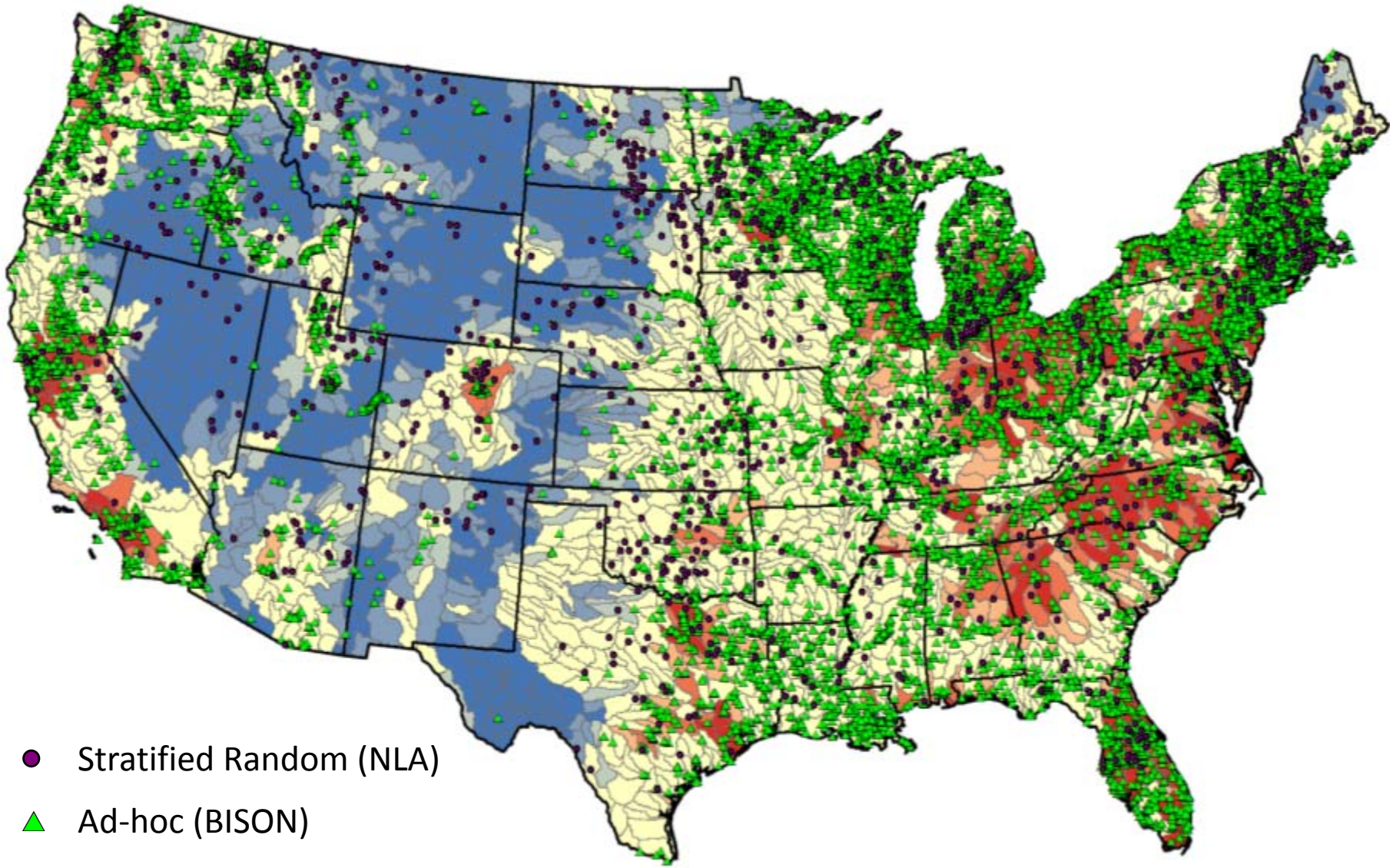

Population Density
Freshwater Fishing Demand
Plant Exotic Richness
Predictor
0
5
10
15
20
25
-2
-1
0
1
2
3

	Freshwater fishing demand		Population density	
Richness	exp(B)	95% CI	exp(B)	95% CI
animal	2.35	[1.95, 2.82]	1.94	[1.81, 2.07]
plant	2.86	[2.34, 3.51]	1.96	[1.81, 2.11]
total	2.55	[2.15, 3.03]	1.95	[1.83, 2.07]

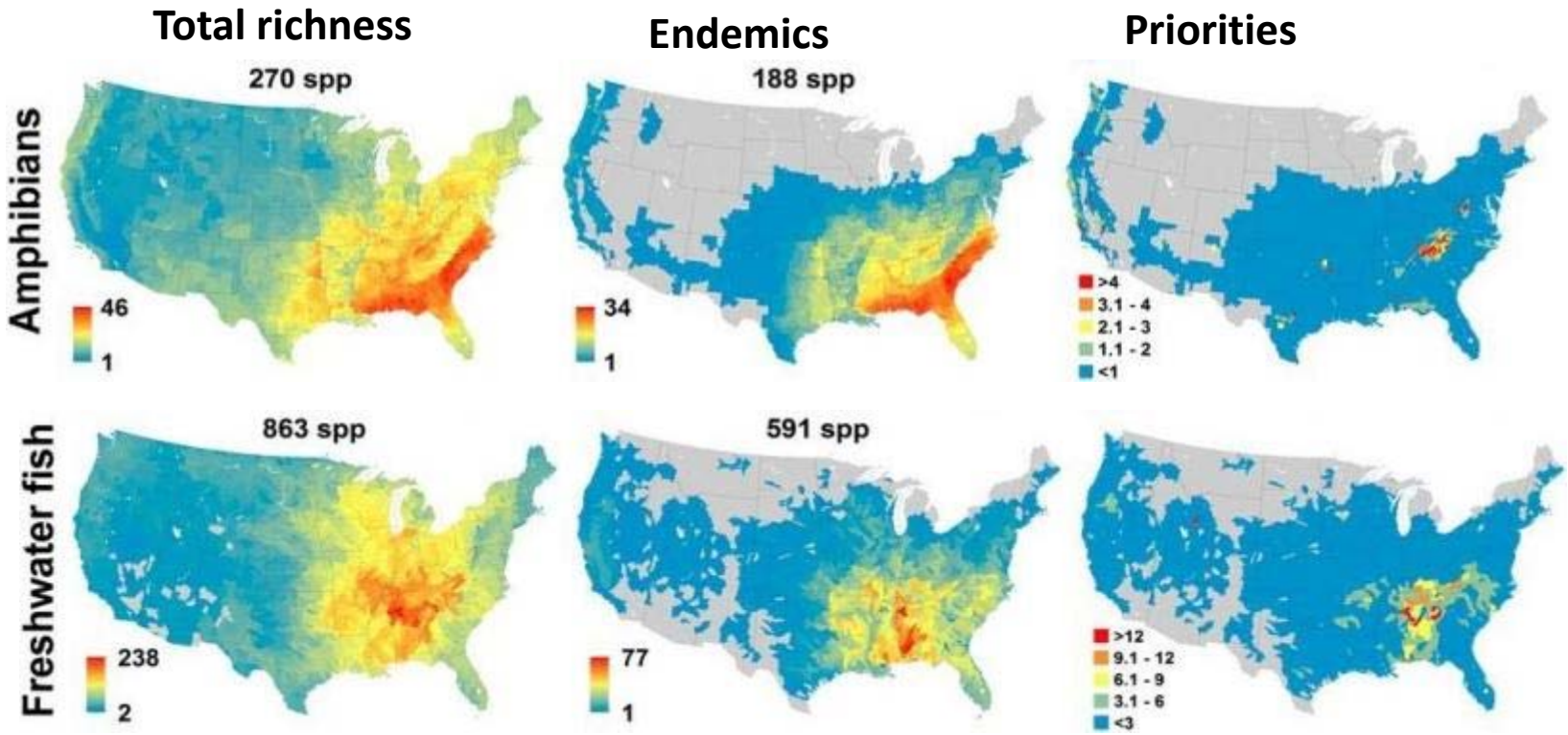
Future work:

1. Investigate the effect of search bias
2. Assess threat of aquatic species invasions to biodiversity and conservation areas

Potential search bias of ad hoc datasets



- Now we can investigate the drivers of aquatic species invasions and their impacts and how they vary geographically across the U.S.
- Assess threats to endemic species, protected areas, threatened & endangered species



Biodiversity of the lower continental United States and priority areas for individual taxa.

Clinton N. Jenkins et al. PNAS 2015;112:5081-5086

Please send questions/comments to:

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