

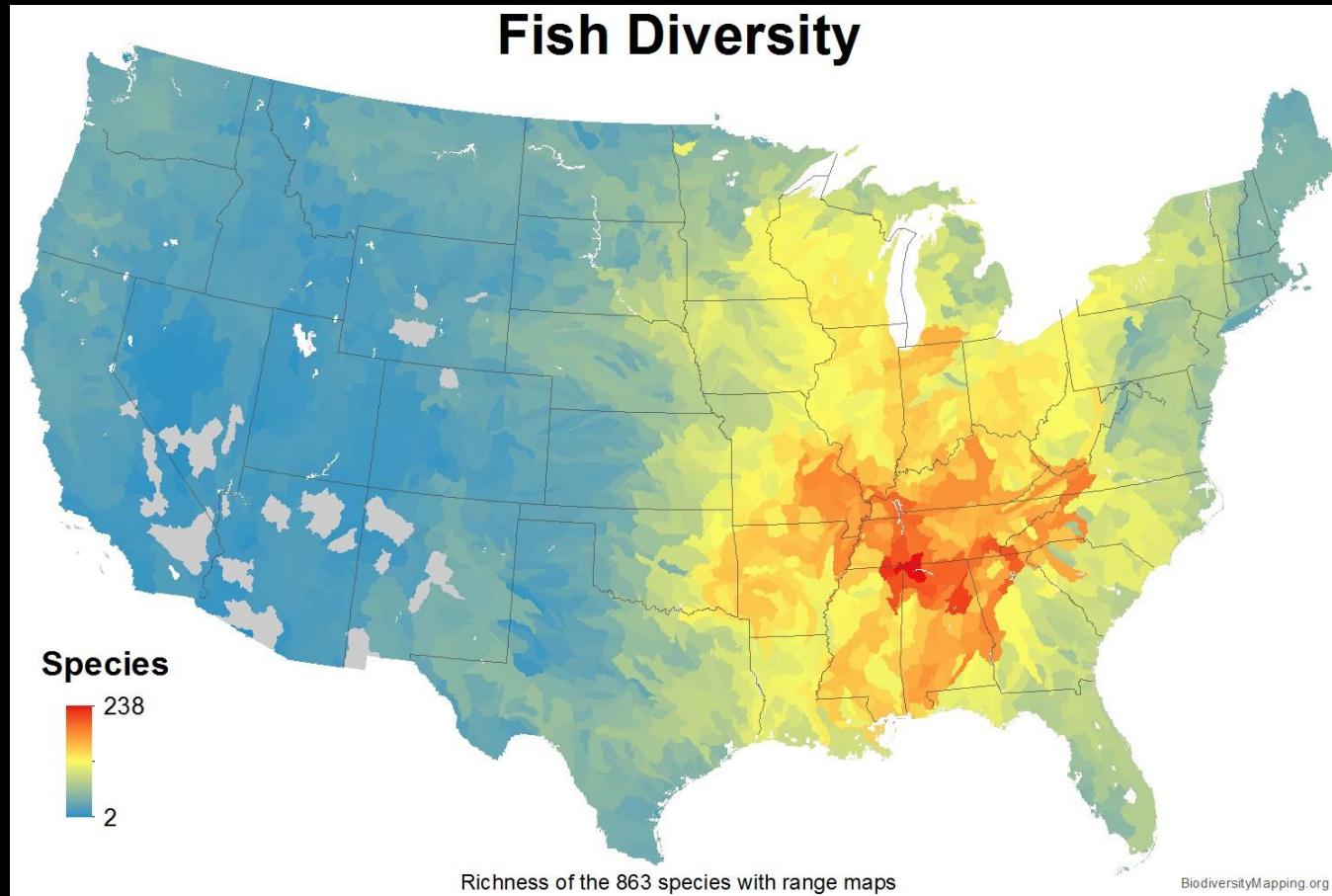
The Southeast Aquatic Conservation Strategy

Duncan Elkins¹, Sarah Sweat², Katie Hill¹, Bernie Kuhajda², Anna George², and Seth Wenger¹

¹River Basin Center, University of Georgia, Athens, GA

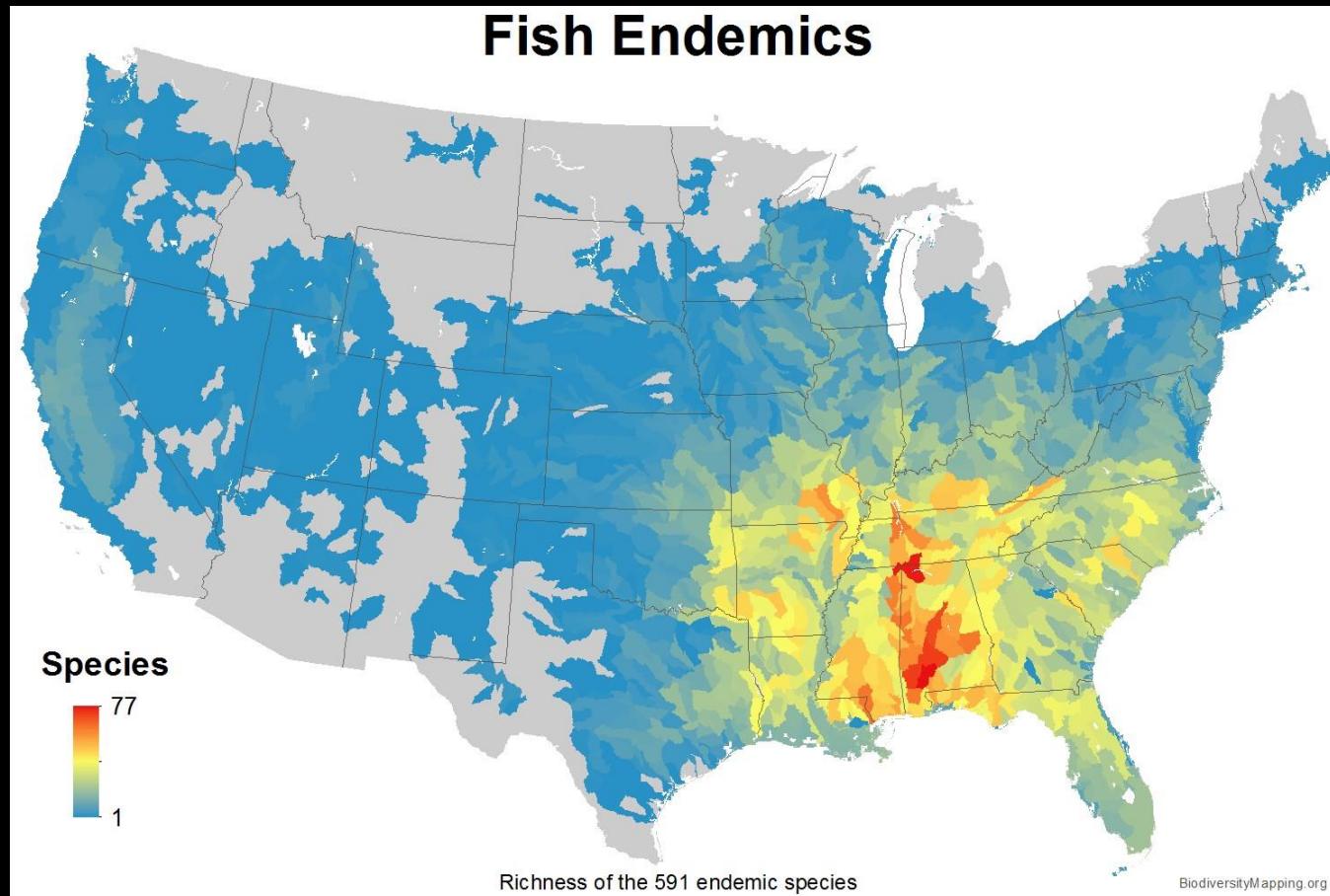
²Tennessee Aquarium Conservation Institute, Chattanooga, TN

Context



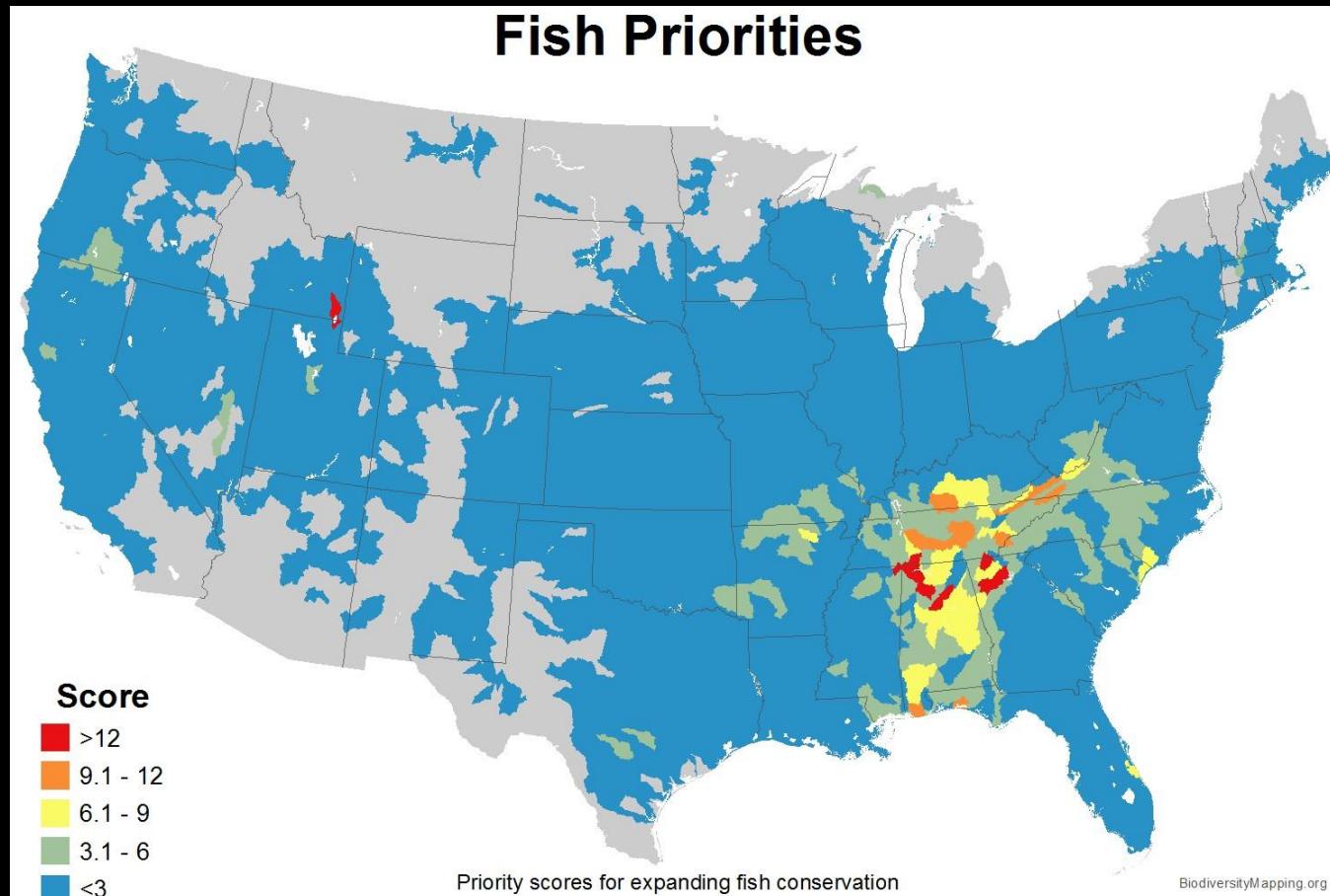
Jenkins, et al., 2015 PNAS

Context



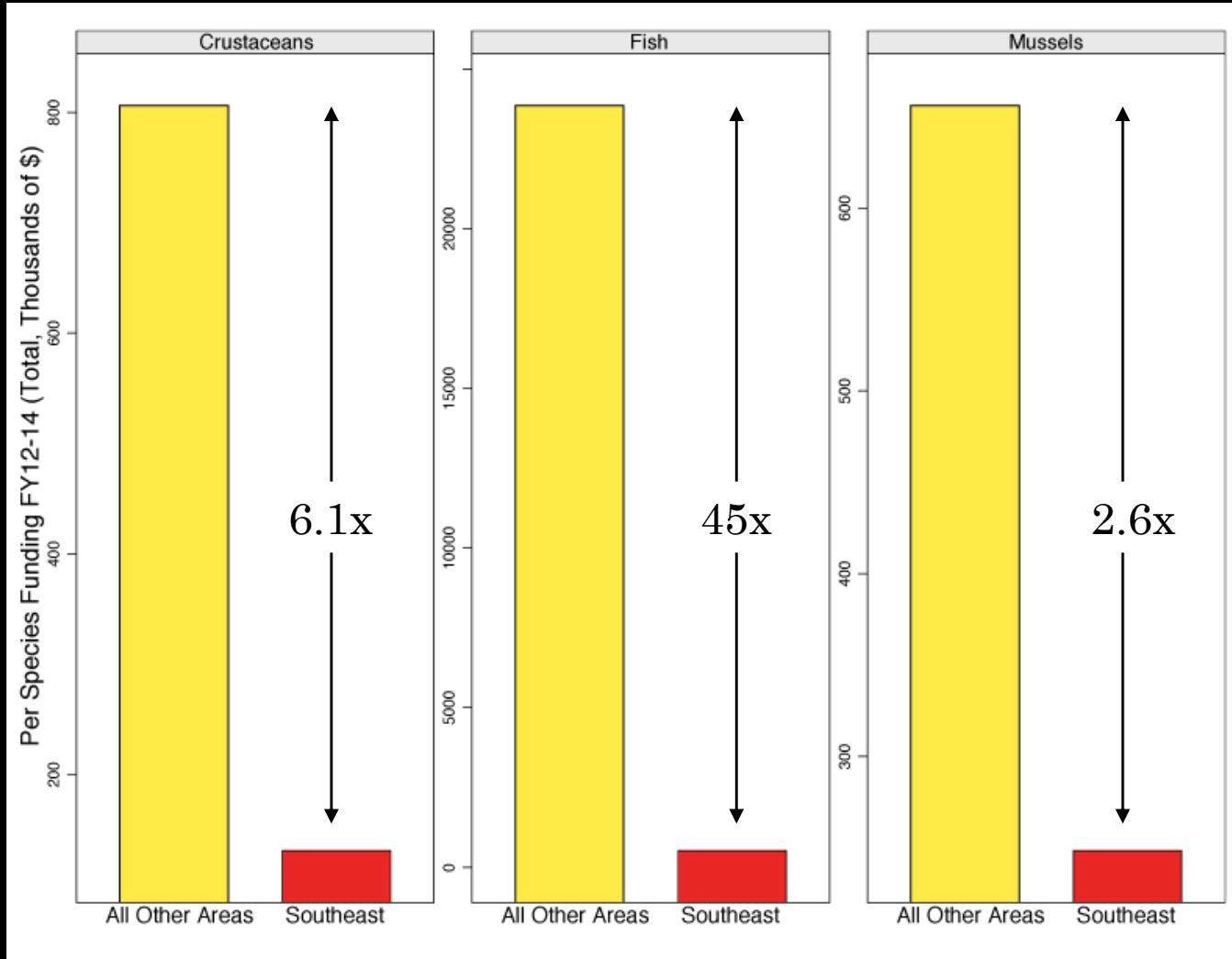
Jenkins, et al., 2015 PNAS

Context



Jenkins, et al., 2015 PNAS

Context (Sobering)



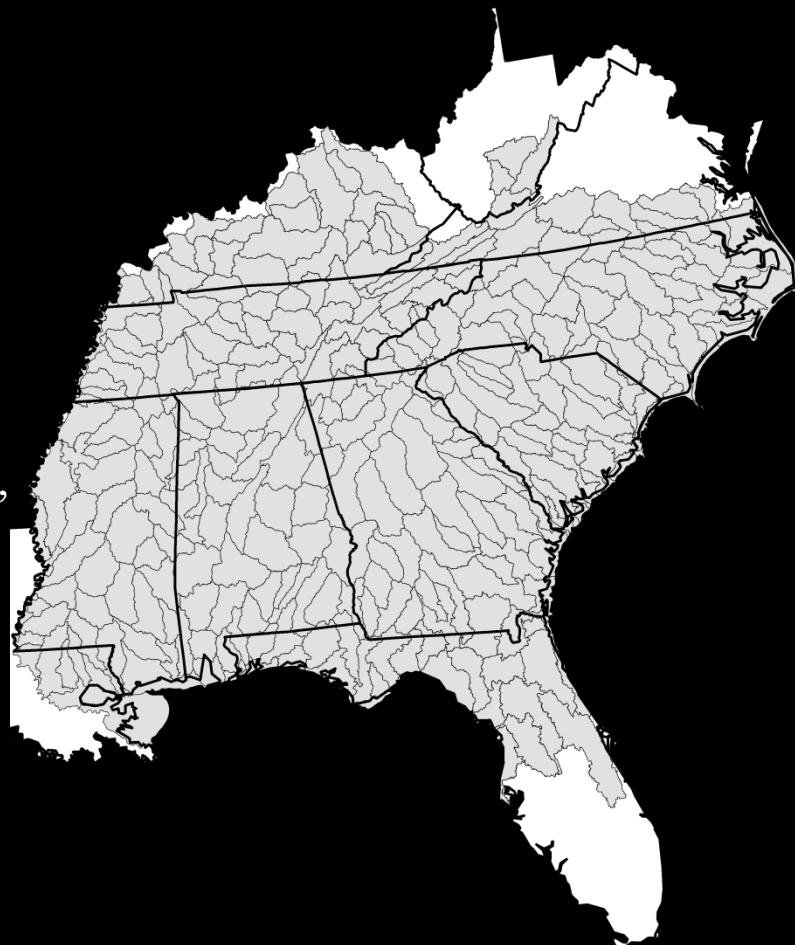
Goals

- Identify areas high biodiversity and unique fauna within the Southeast
- Use this data for prioritization of conservation and future funding opportunities



Study Area: “The Southeast”

- HUC8s as analysis unit
- Boundaries based on fish biogeography
- 290 HUC 8 Study area to encompass the southeastern biodiversity of fishes, crayfishes, and mussels



Why not just use the SWAPs?

Must reconcile states' decisions about appropriate scale of conservation planning

For example:

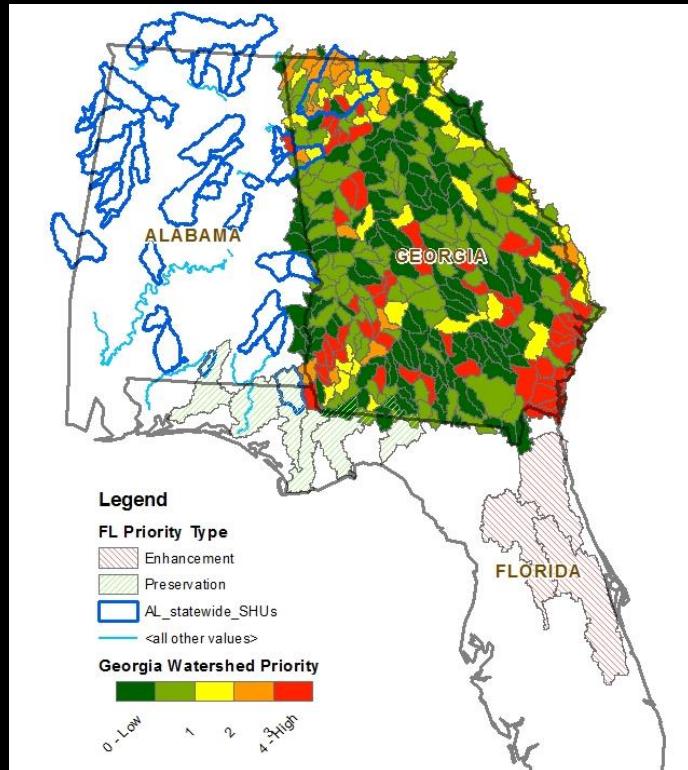
Alabama: SHUs & SRUs

(HUC8s and smaller, River segments)

Florida: Priority Basins (Preservation vs Enhancement)

Georgia: HUC10, priority scores

Also S1/G5 inflation



Plan for the Plan

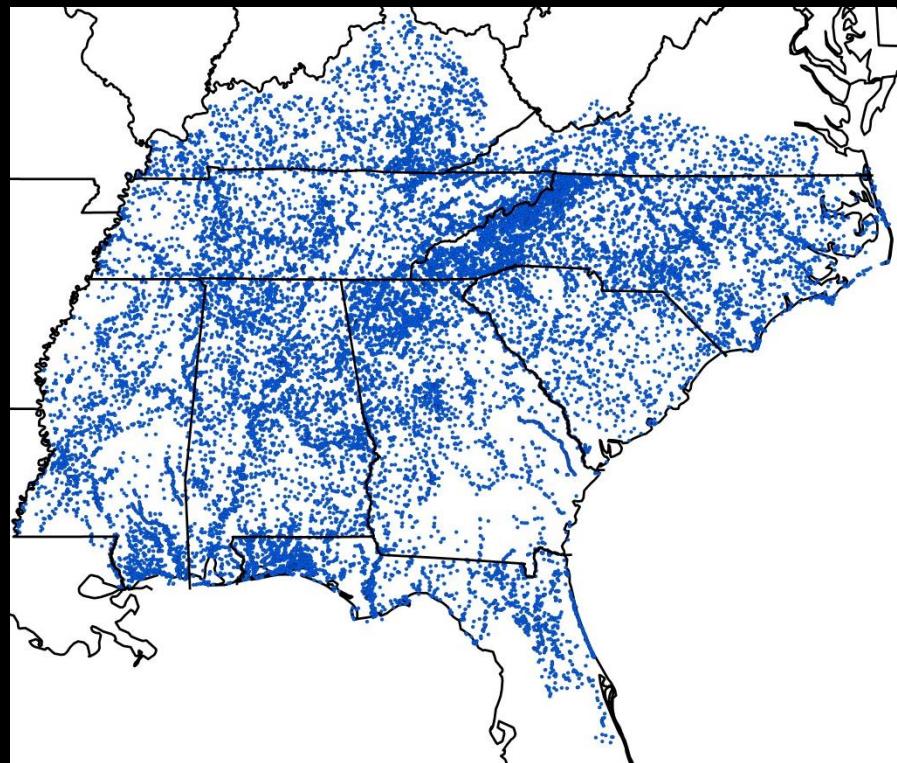
- Backstop the selection of priority areas with whatever layers of aquatic biodiversity we could assemble with sufficient uniformity at regional scale.

General Procedure

- Obtain point/polygon data of species occurrence
- Aggregate to HUC-8 level
- Generate range maps for each species
- Check range maps
- Calculate richness, endemism, imperilment

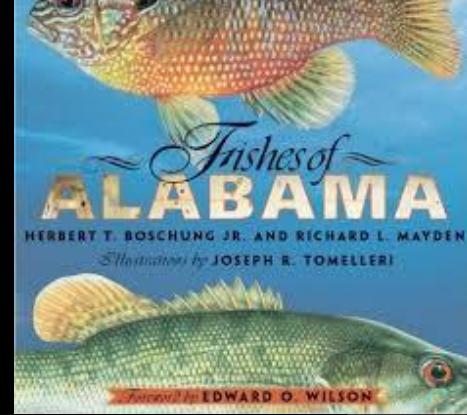
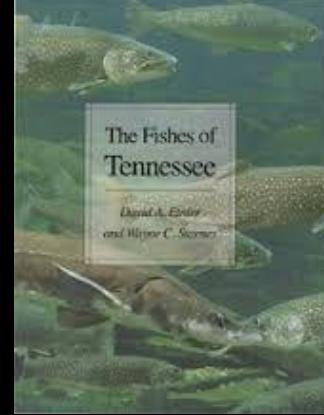
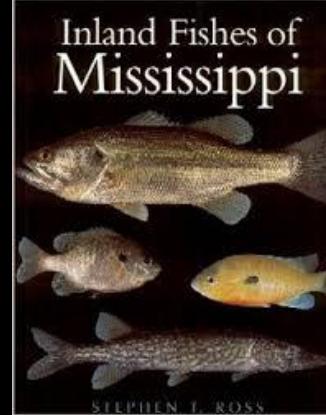
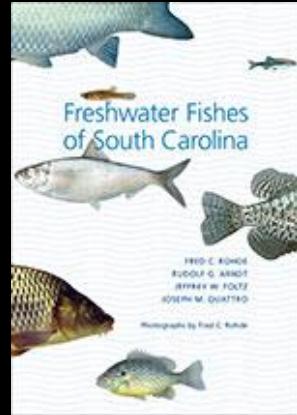
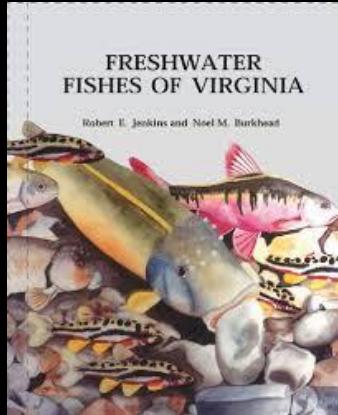
A (half-) million points of fish

- Primarily from fish databases (MARIS, GBIF, FishNet2)
- ~500,000 records

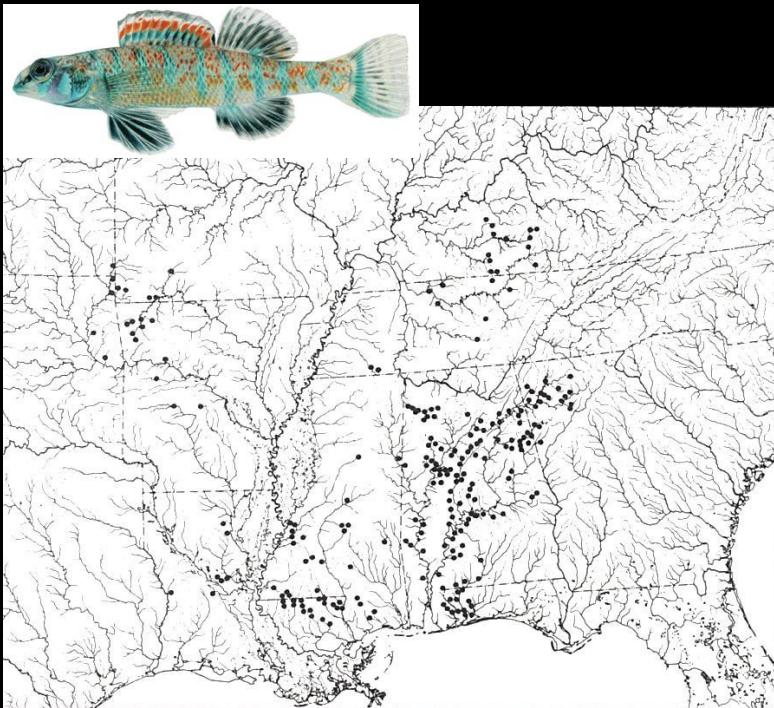


Vetting Fish Data

- Fish ranges checked against published “Fishes of . . .” books or online atlases for each state (AL, FL, GA, KY, MS, NC, SC, TN, VA, WV)
- Only native ranges of fishes were delineated
- Deleted non-native distributions



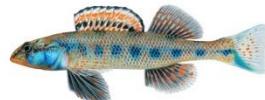
New Taxonomy



Five New Fish Species from Rivers of the United States of America
Named in Honor of US Presidents and Vice President



Etheostoma teddyroosevelt
Highland Darter



Etheostoma jimmycarter
Bluegrass Darter



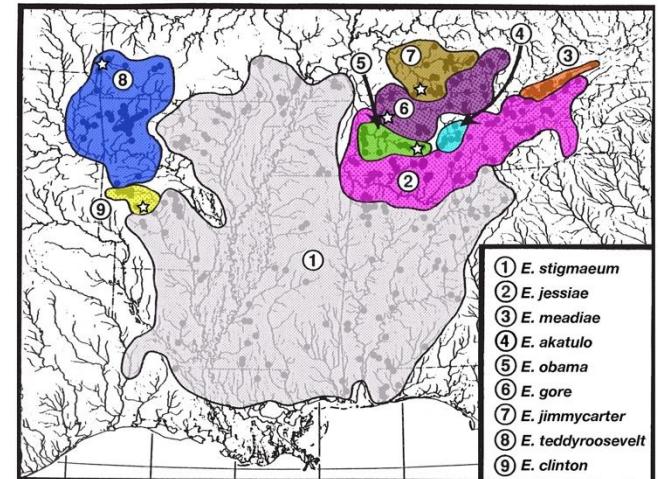
Etheostoma clinton
Beaded Darter



Etheostoma gore
Cumberland Darter



Etheostoma obama
Spangled Darter



Crayfish Data Sources

- Records from regional astacologists & museums, some state polygons

Susie Adams, USFS

Tyler Black, NCWRC

Chris Skelton, HNTB Corp

Arnie Eversole, Clemson

David Withers, TDEC

Guenter Schuster, GSA

Chris Taylor, INHS

Carl Williams, TWRA

Roger Thoma, Midwest Biodiversity Institute

Bronwyn Williams, NCMNS

Geological Survey of Alabama

Zach Loughman, West Liberty

Jeff Simmons, TVA

Illinois NHS

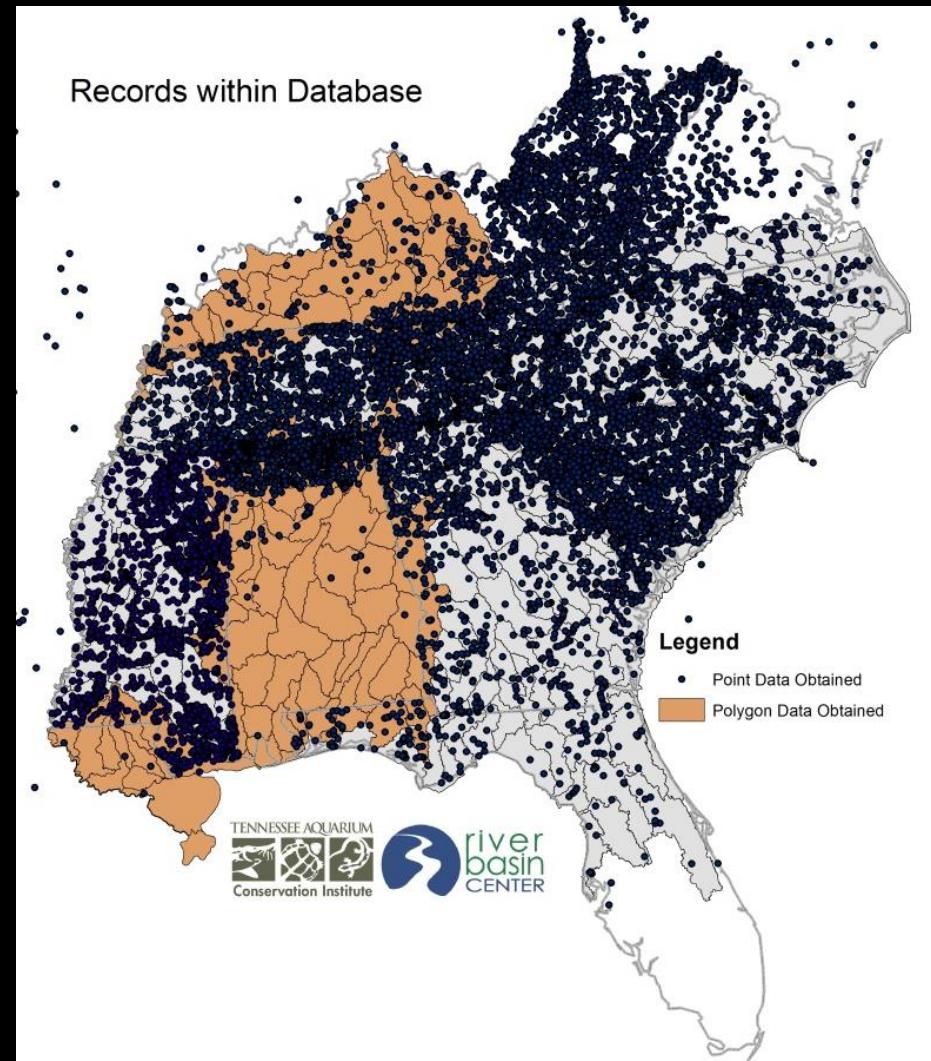
Kentucky DFWR

Smithsonian NMNH

GBIF

Crayfish sampling: surprisingly good!

- ~41,000 points
- High confidence



Crayfish data vetting

- Crayfish summit meeting
- Edit data
- Assign endemism
- Focus on stream species
- Secondary and Tertiary burrowers
- Records from 221 species

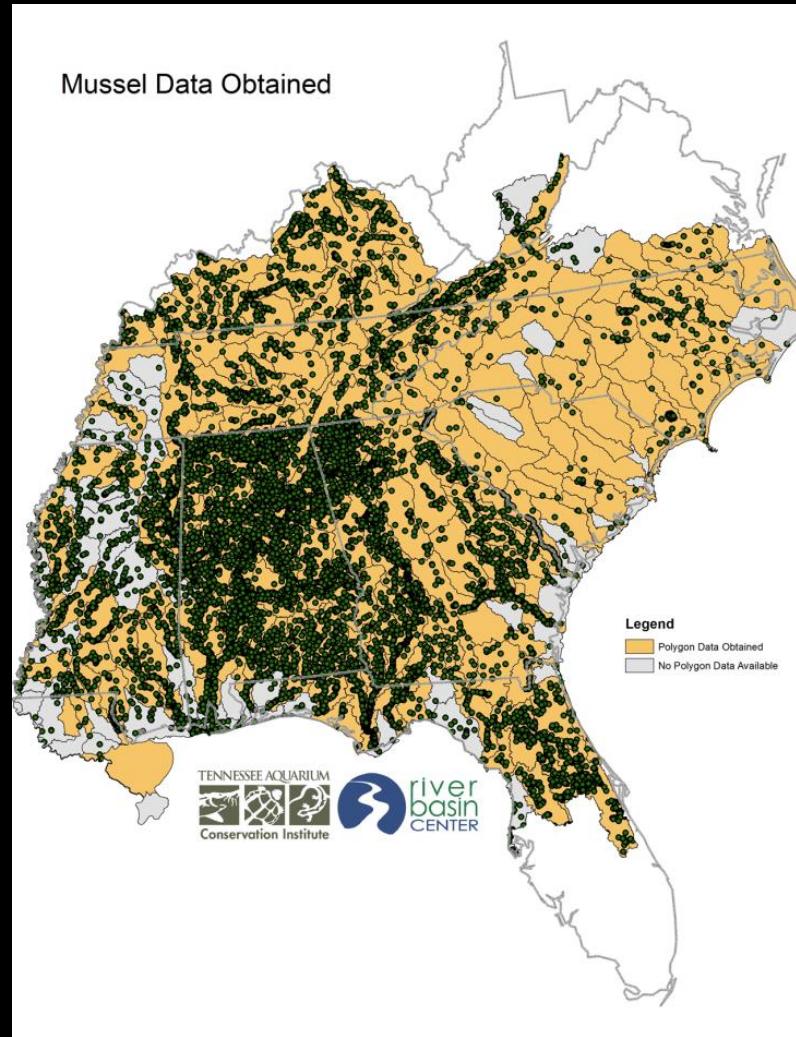


Mussel Data Sources

- Queried museums, state collections, authors
- Jeff Garner, AL DCNR
- Stuart McGregor, GSA
- Jason Wisniewski, GA DNR
- Bob Jones, MS Museum of Natural Sciences
- Art Bogan, NC Museum of Natural Sciences
- Ohio State University Museum of Biological Diversity
- Jim Williams, Florida Museum of Natural History
- Kentucky DFWR

Mussel sample distribution

- ~185,000 records



Mussel Data Vetting

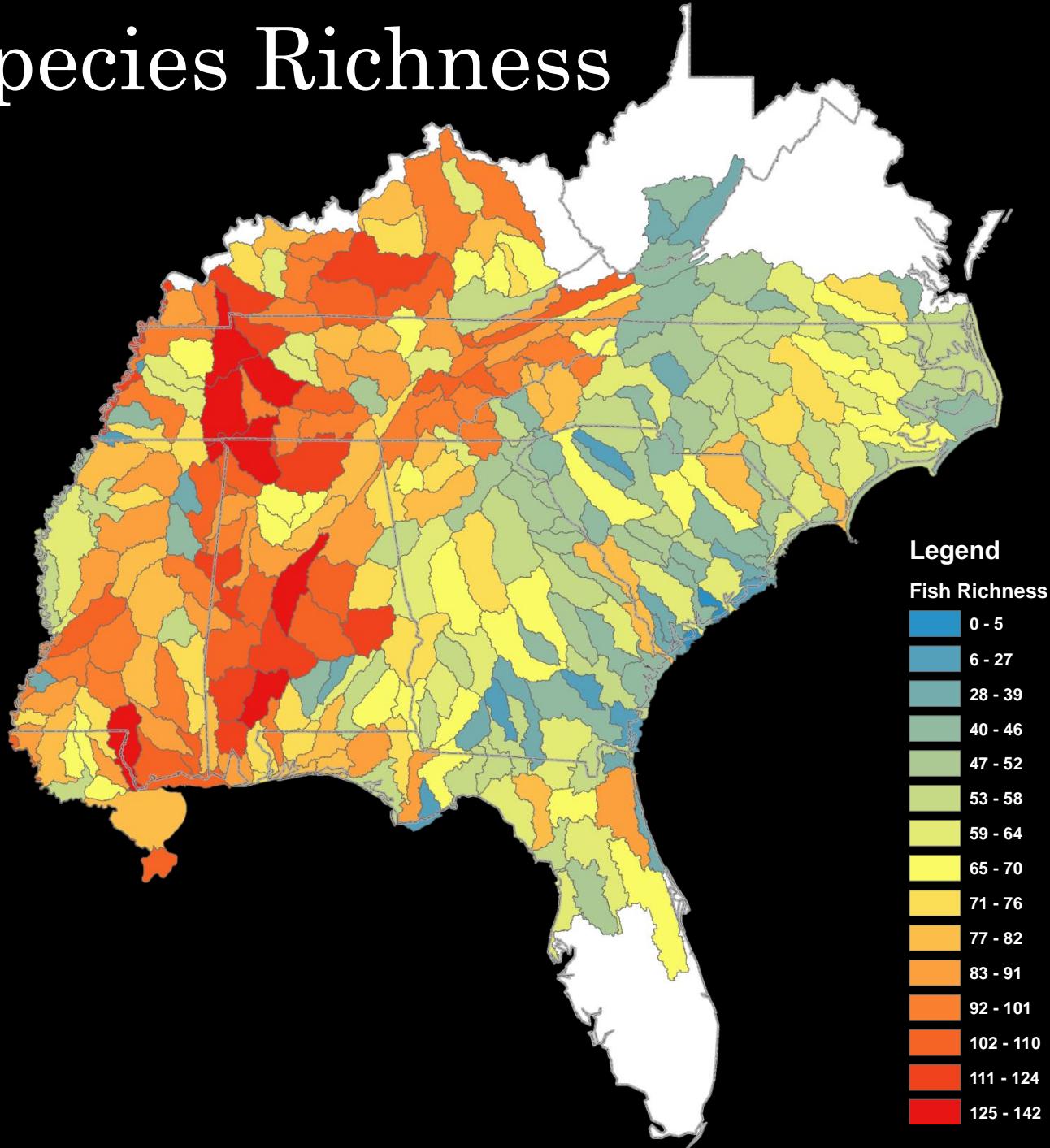
238 maps subset by state (roughly), vetted via email

- Jason Wisniewski, GADNR
- Bob Jones, MS Museum of Natural Sciences
- Art Bogan, NC Museum of Natural Sciences
- Jim Williams, FL Museum of Natural History
- Bob Butler, USFWS
- Wendell Haag, USFS
- Jess Jones, VADFWC
- Don Hubbs, TWRA

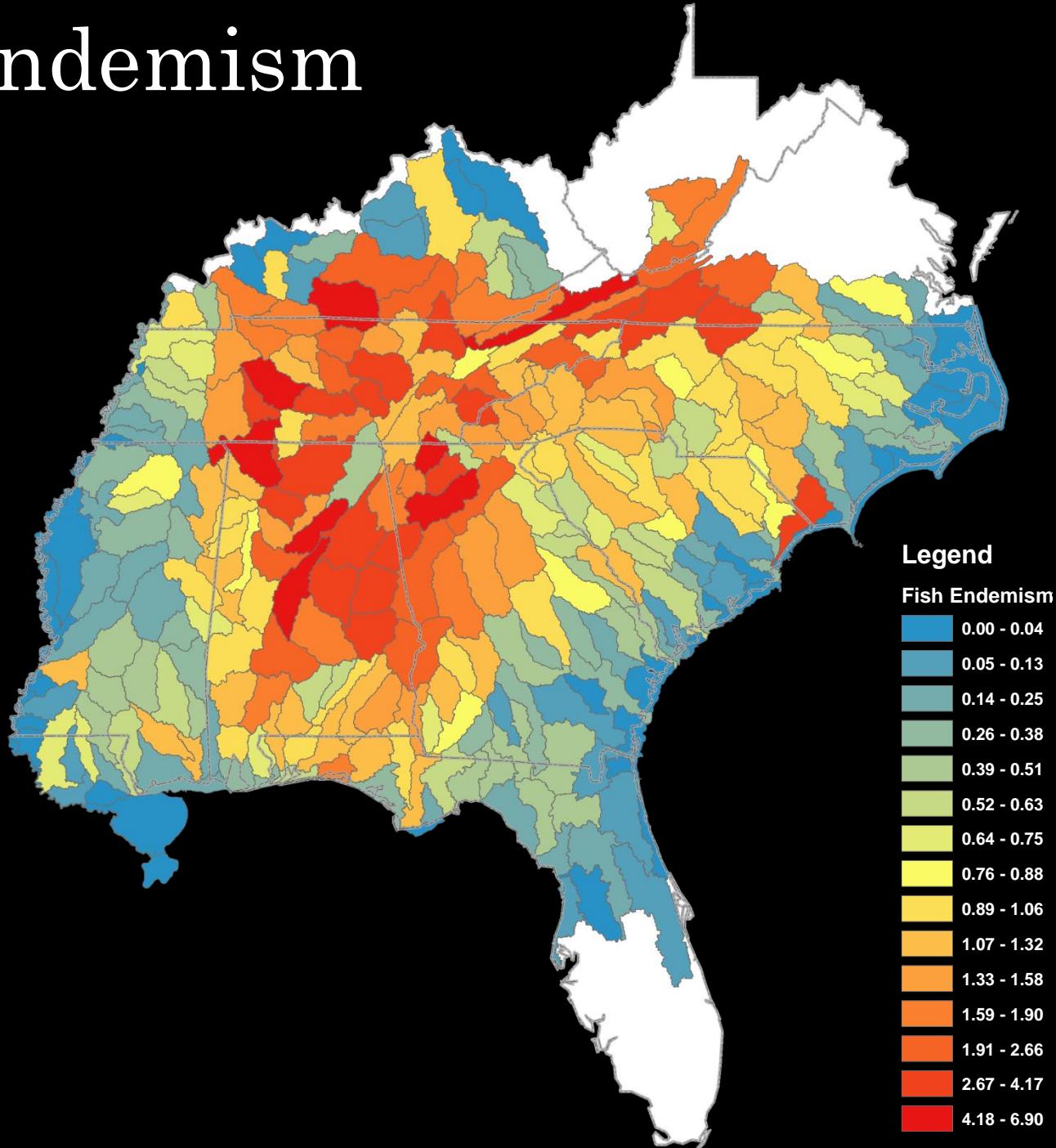
Scoring the Hucs

- Richness: Sum of species with records in HUC
- Endemism:
 - Only species with range entirely within project area
 - Sum the number of HUCs in which each species appears
 - Divide the 1s in the presence/absence matrix by HUCs in range
 - Sum within HUCs, as with richness
- Imperilment:
 - Using most recent literature and professional societies' imperilment lists
 - Weights: 3 points for each endangered, 2 points for threatened, 1 for vulnerable
 - Sum within HUCs, as with richness

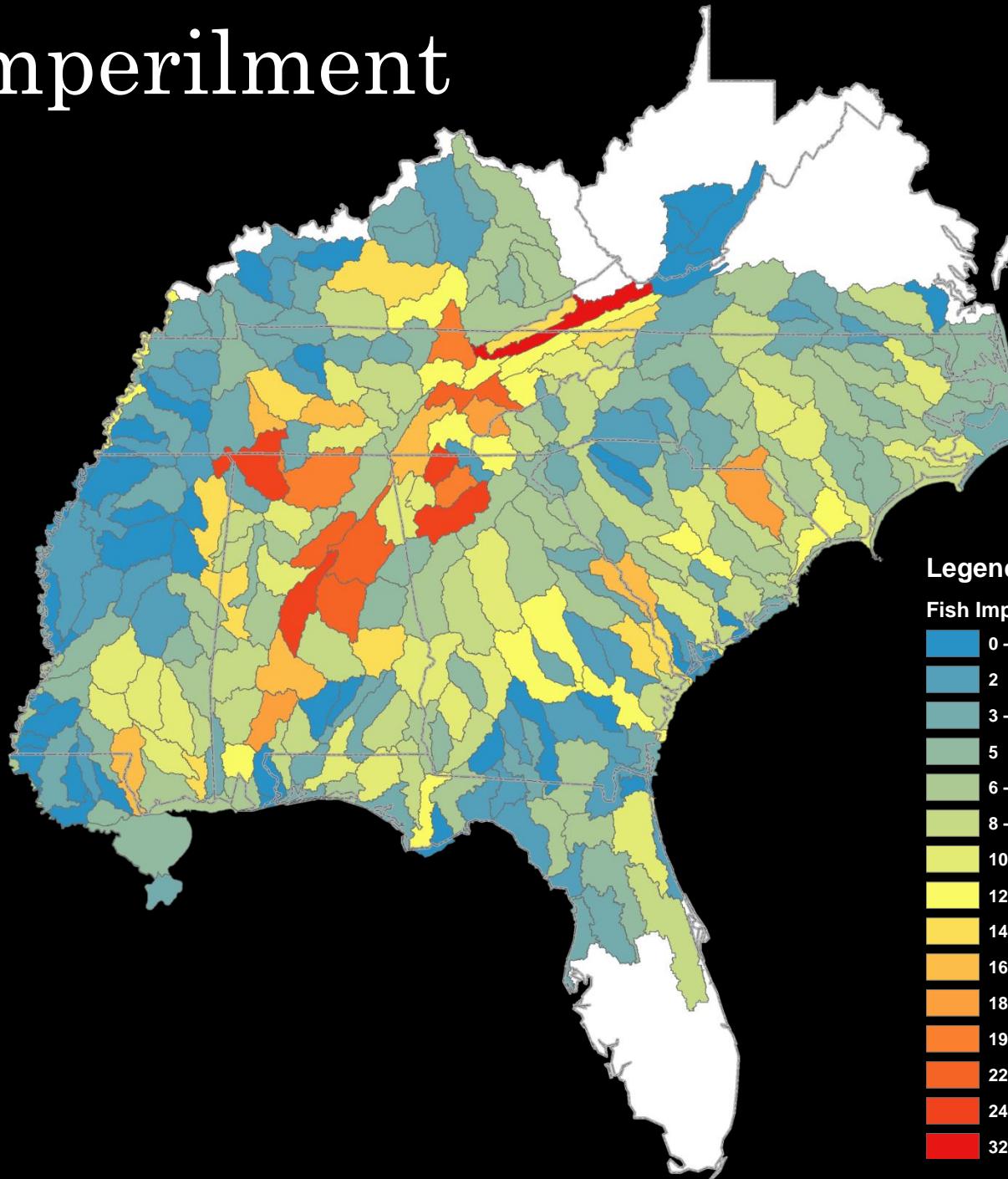
Fish Species Richness



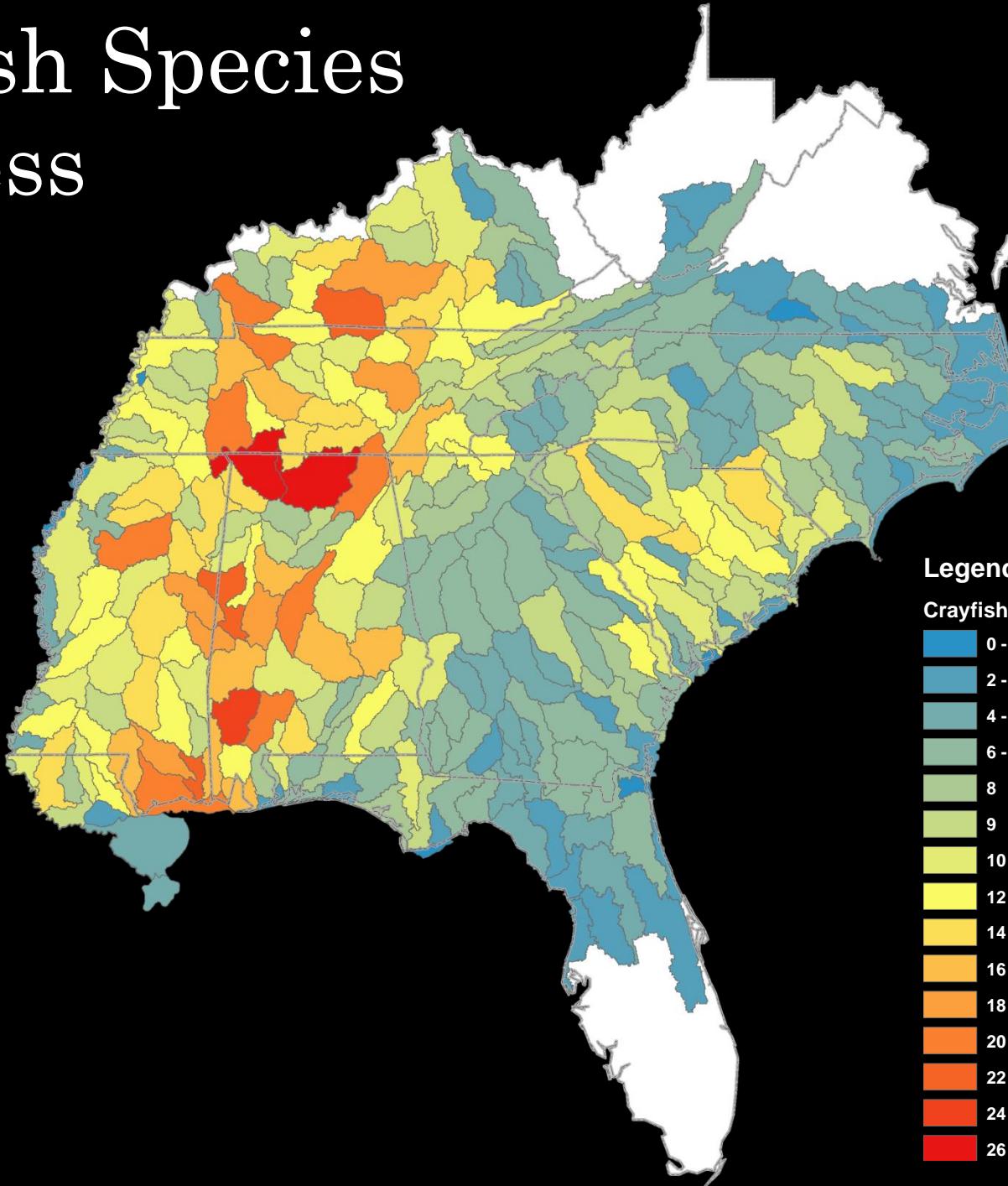
Fish Endemism



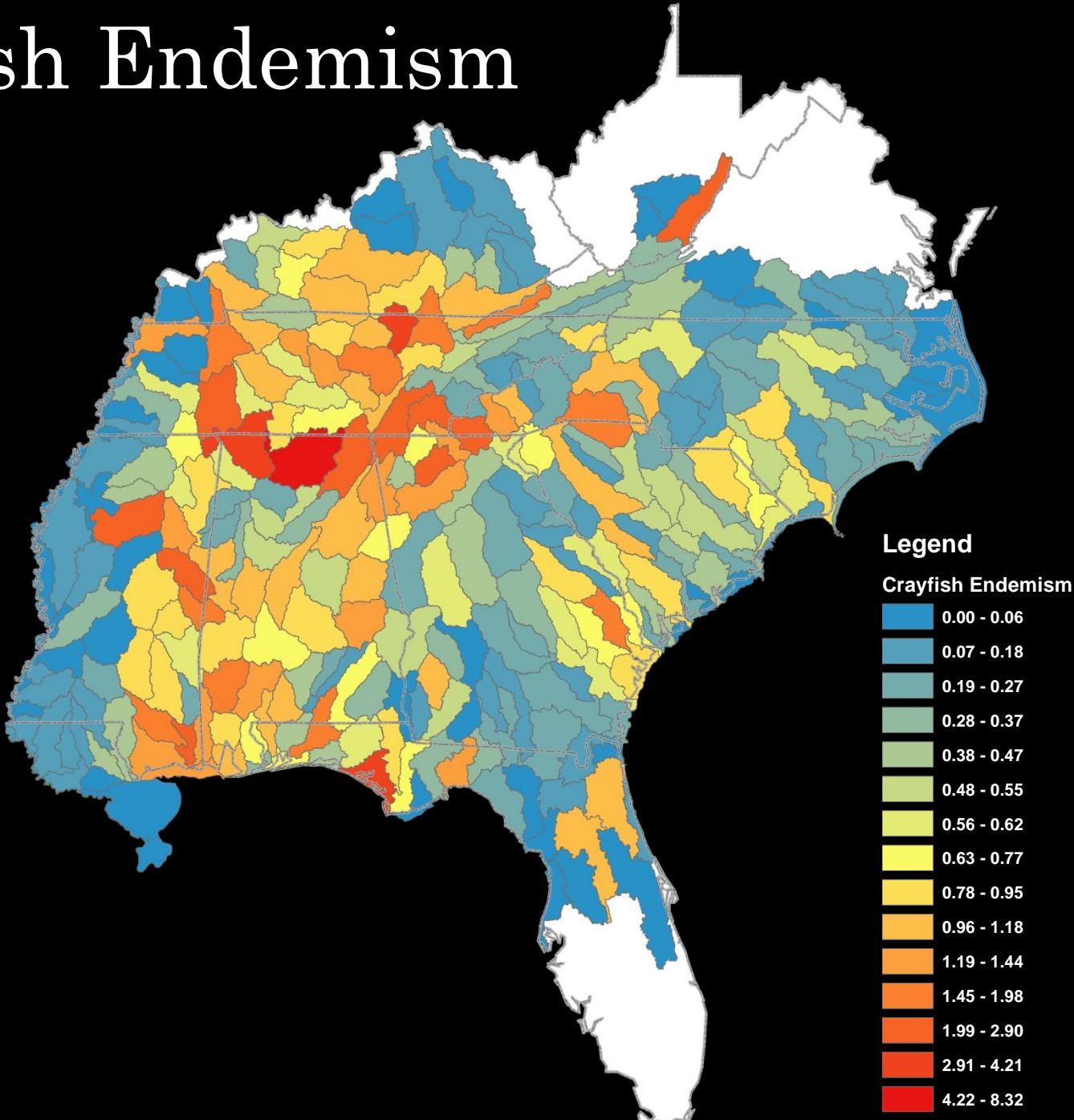
Fish Imperilment



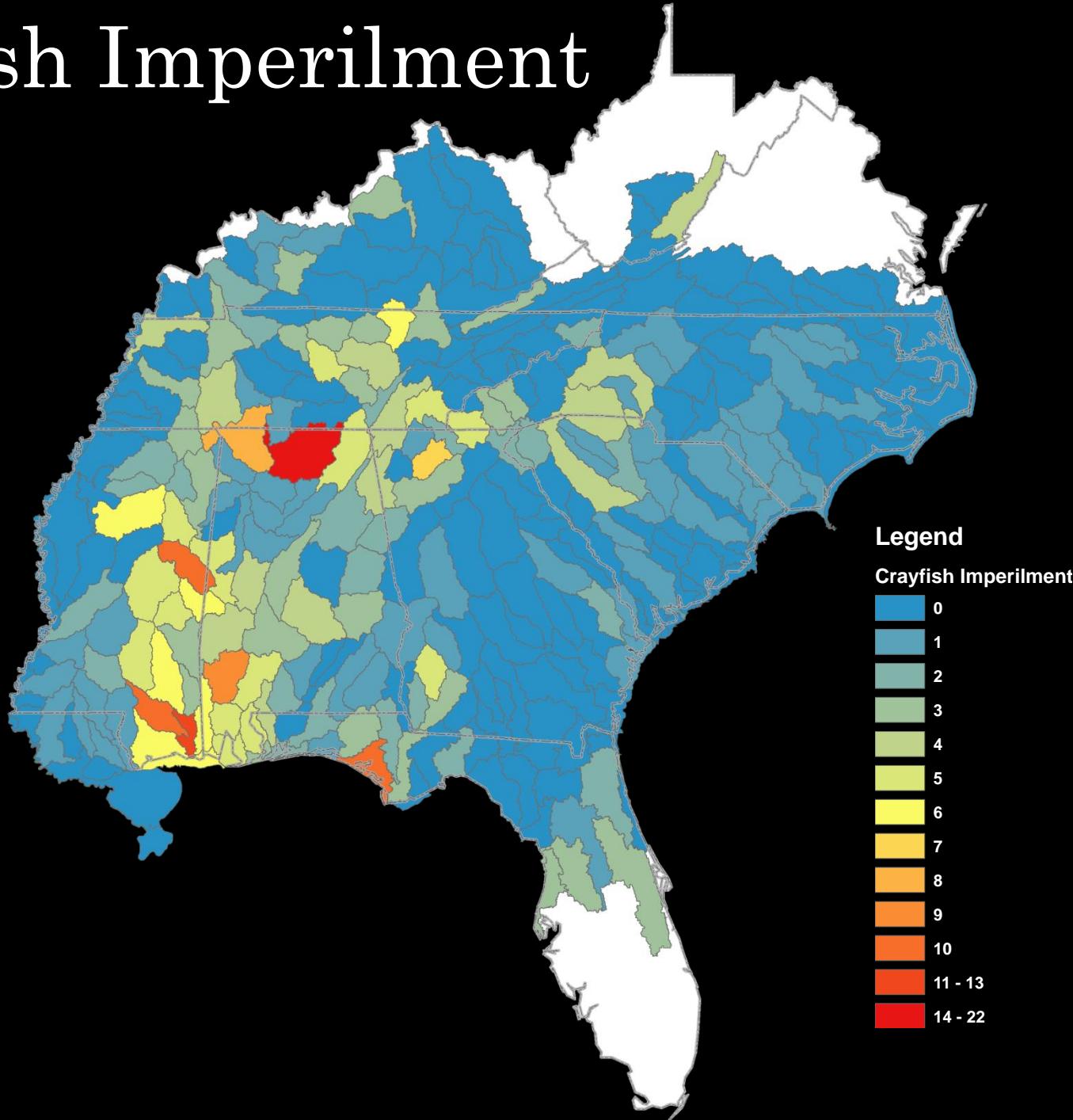
Crayfish Species Richness



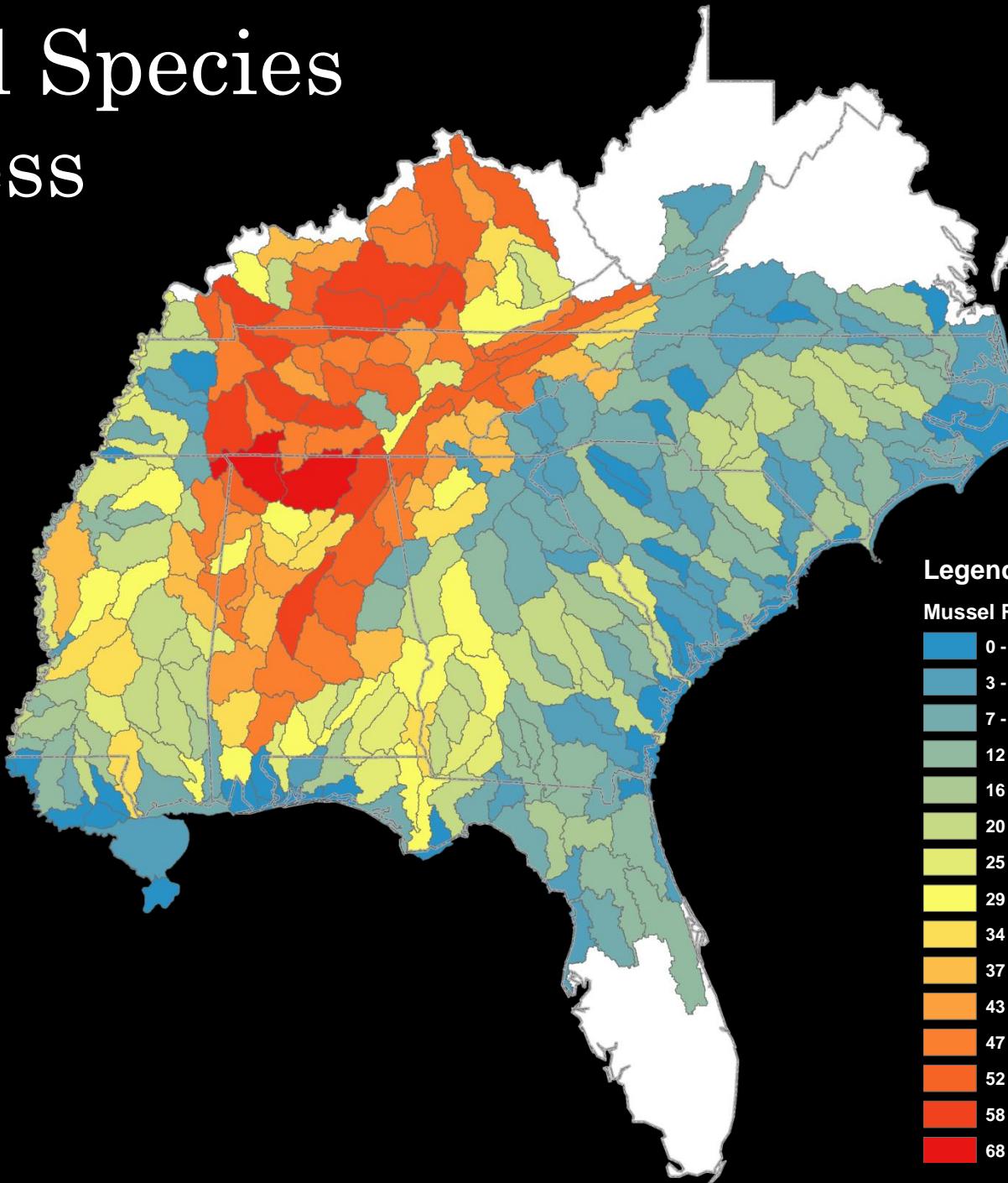
Crayfish Endemism



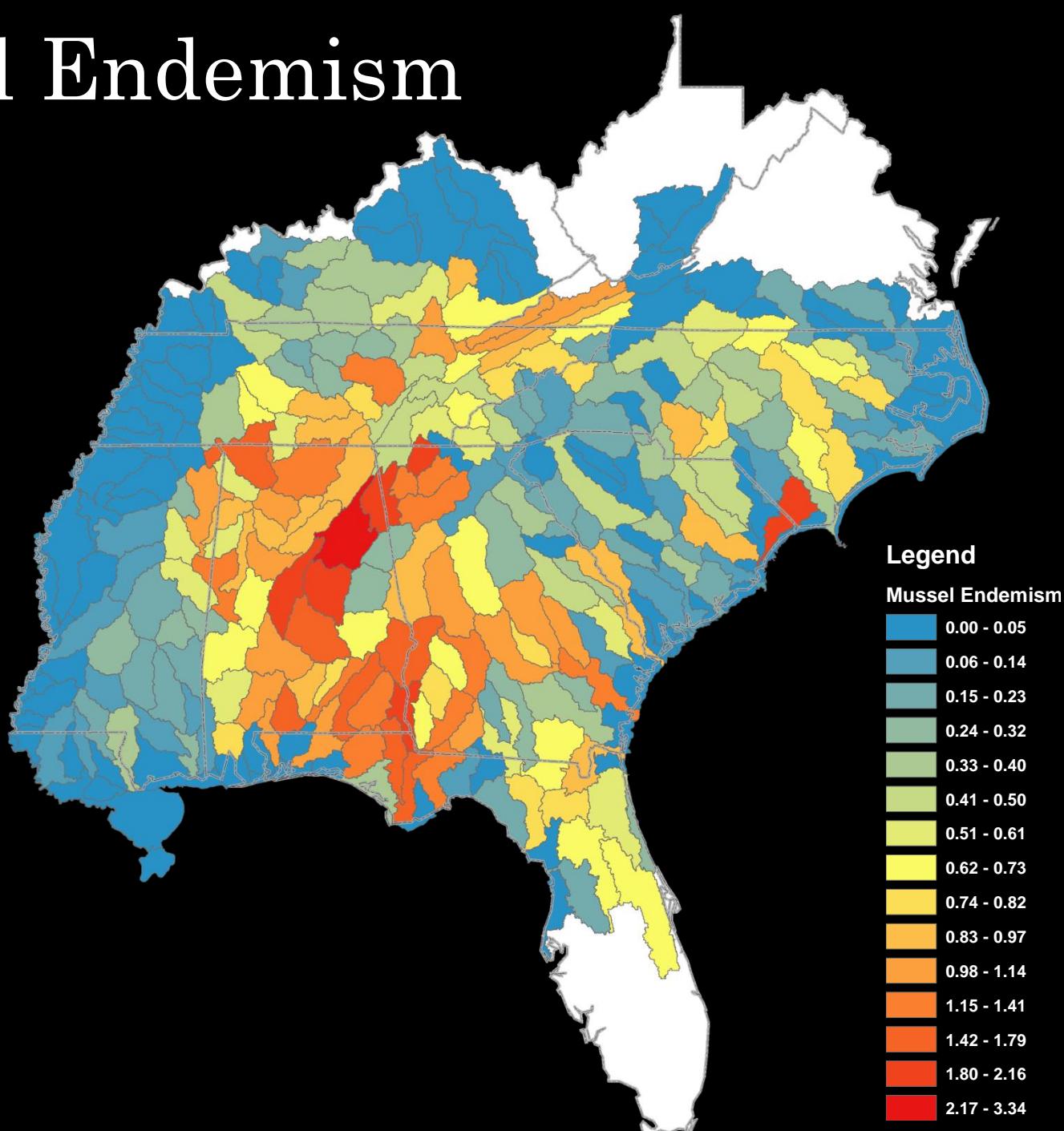
Crayfish Imperilment



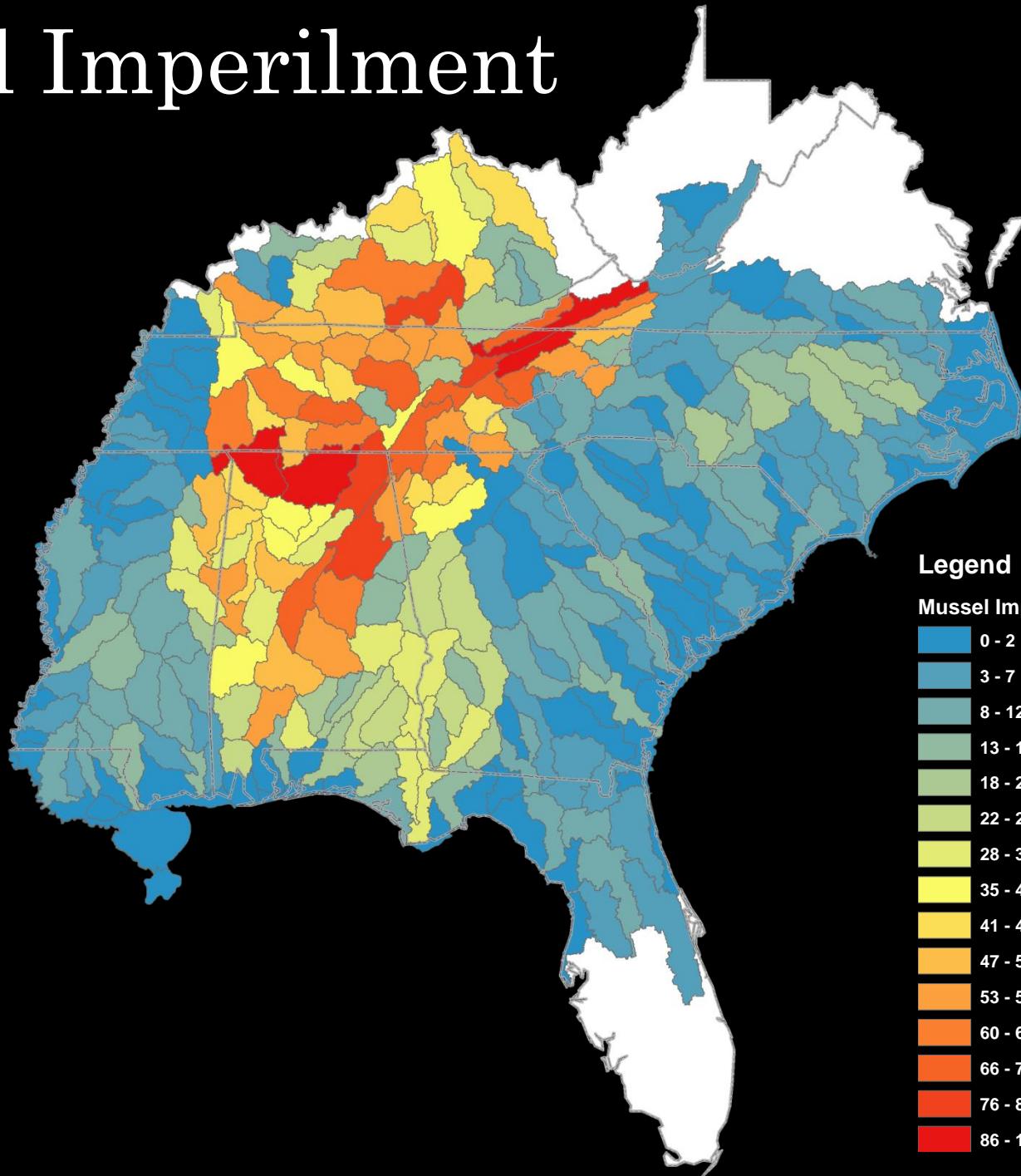
Mussel Species Richness



Mussel Endemism

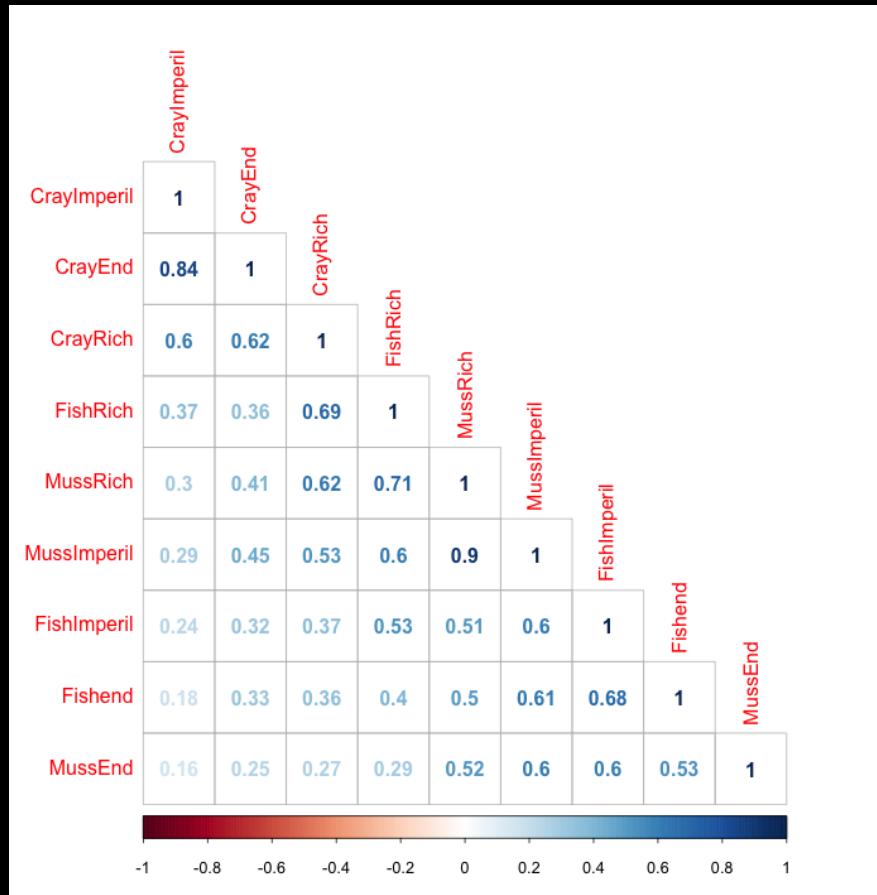


Mussel Imperilment



What to make of this?

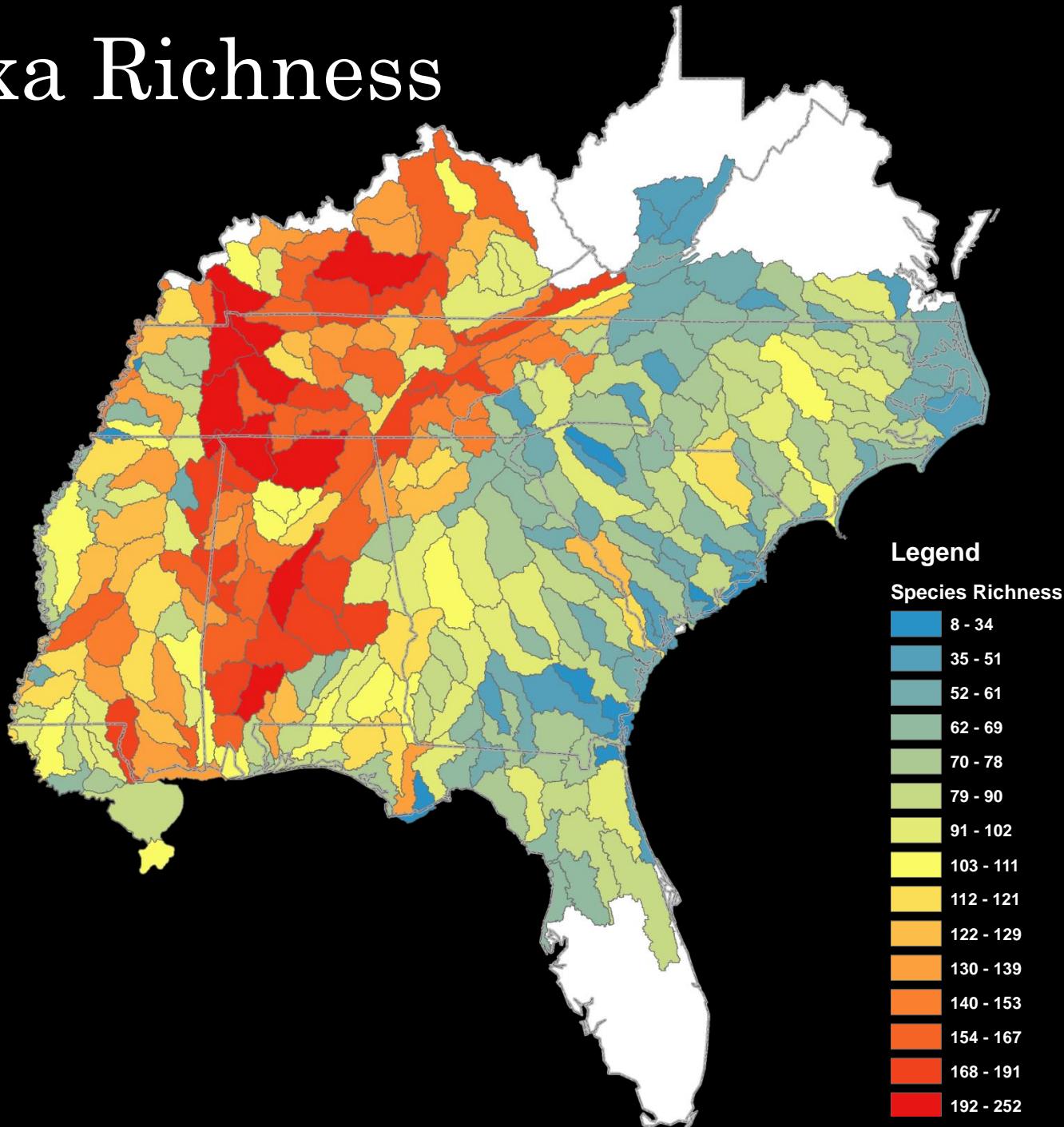
- Richness, Endemism, Imperilment correlated, but imperfectly



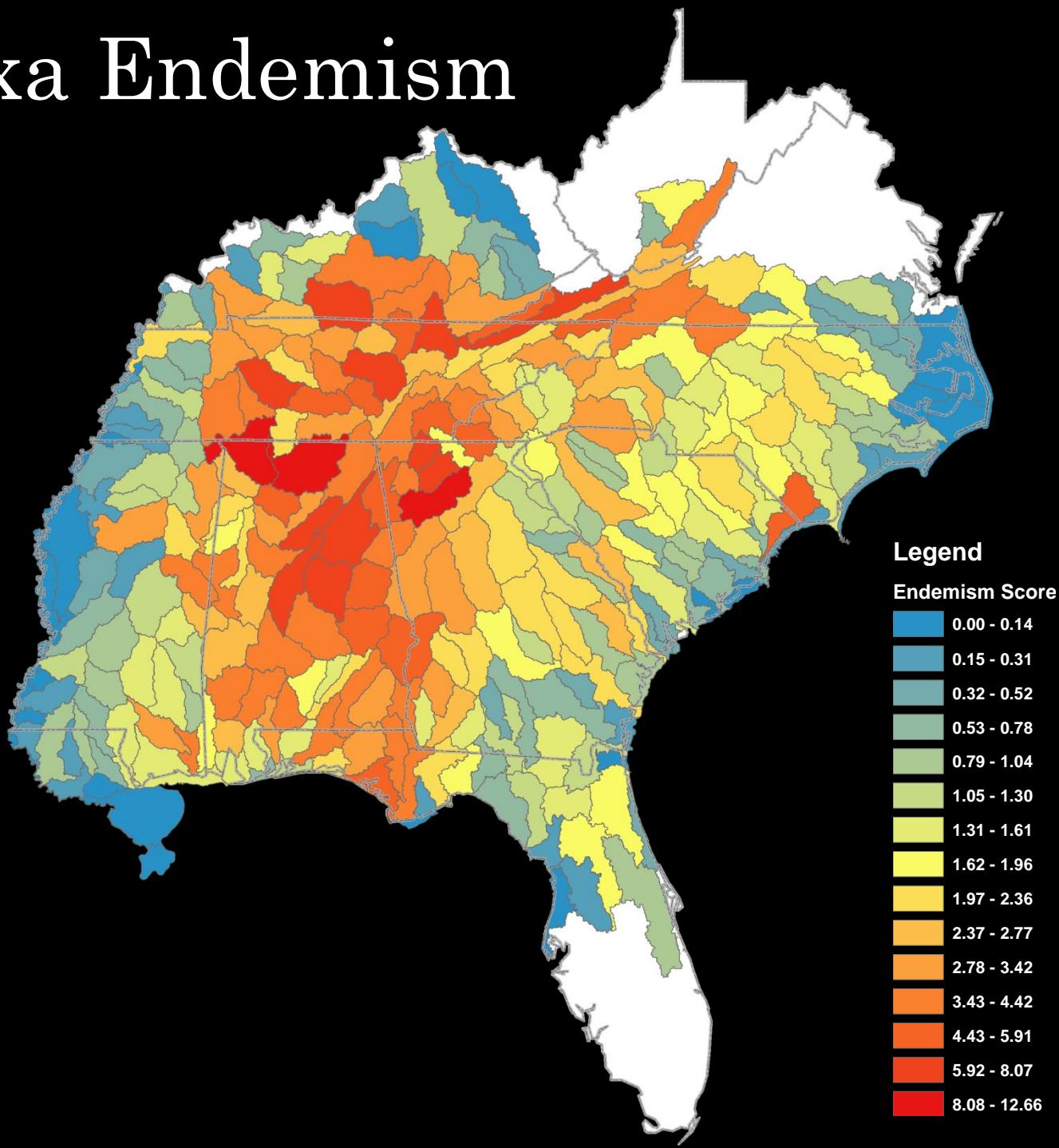
All species are created equal.
All taxa? Maybe not.

- Debate: weight taxa equally or pool species?

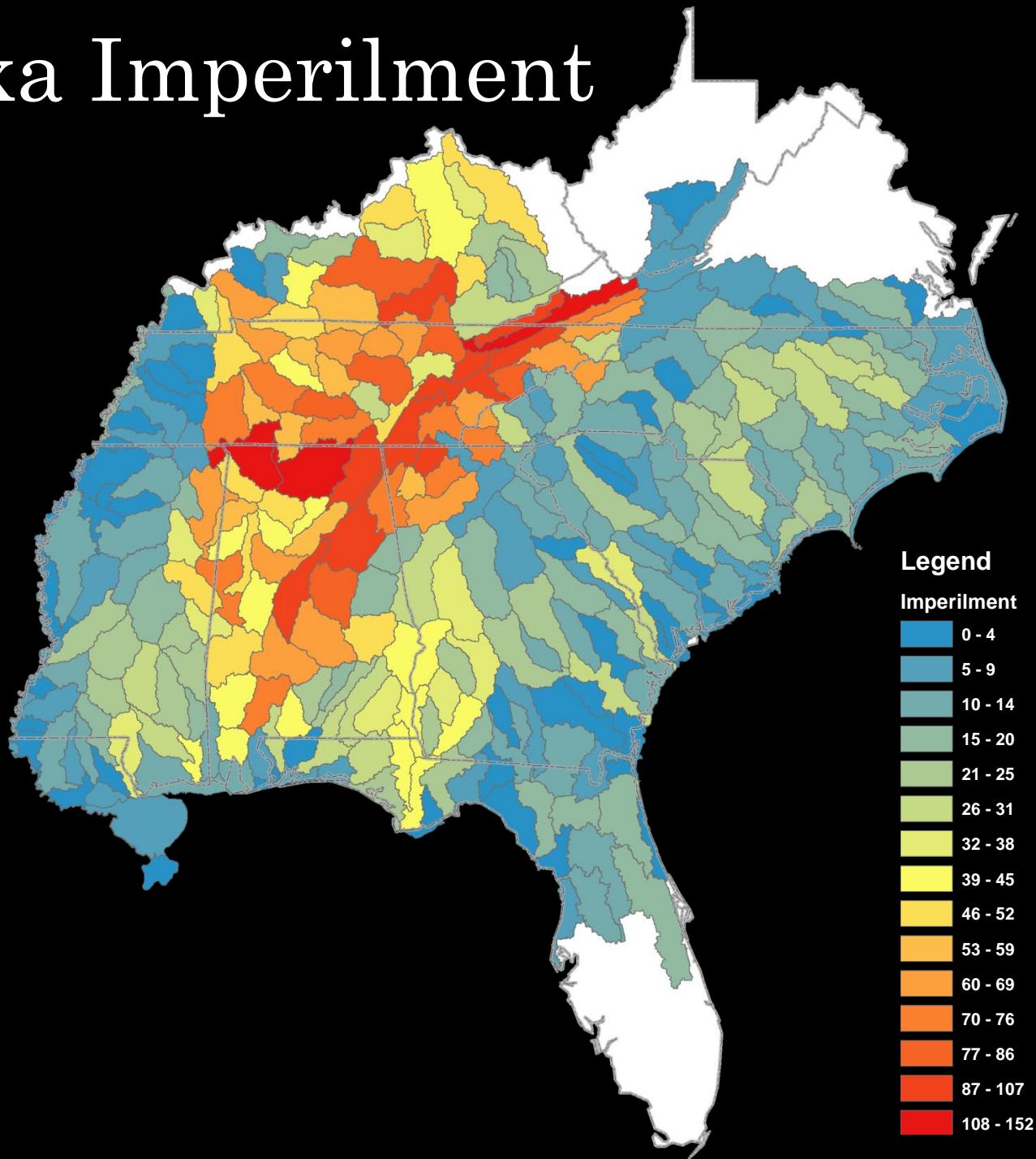
All Taxa Richness



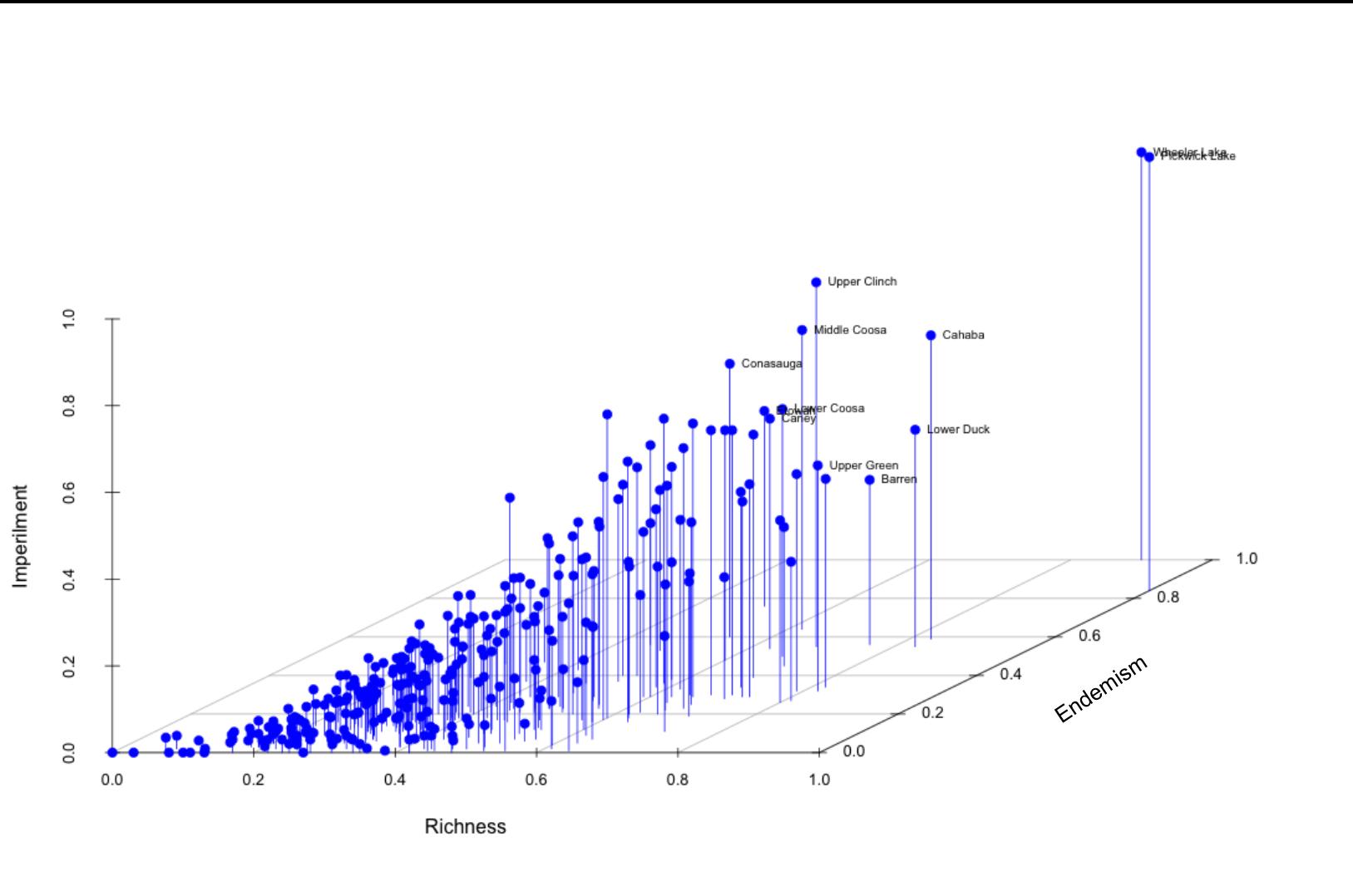
All Taxa Endemism



All Taxa Imperilment



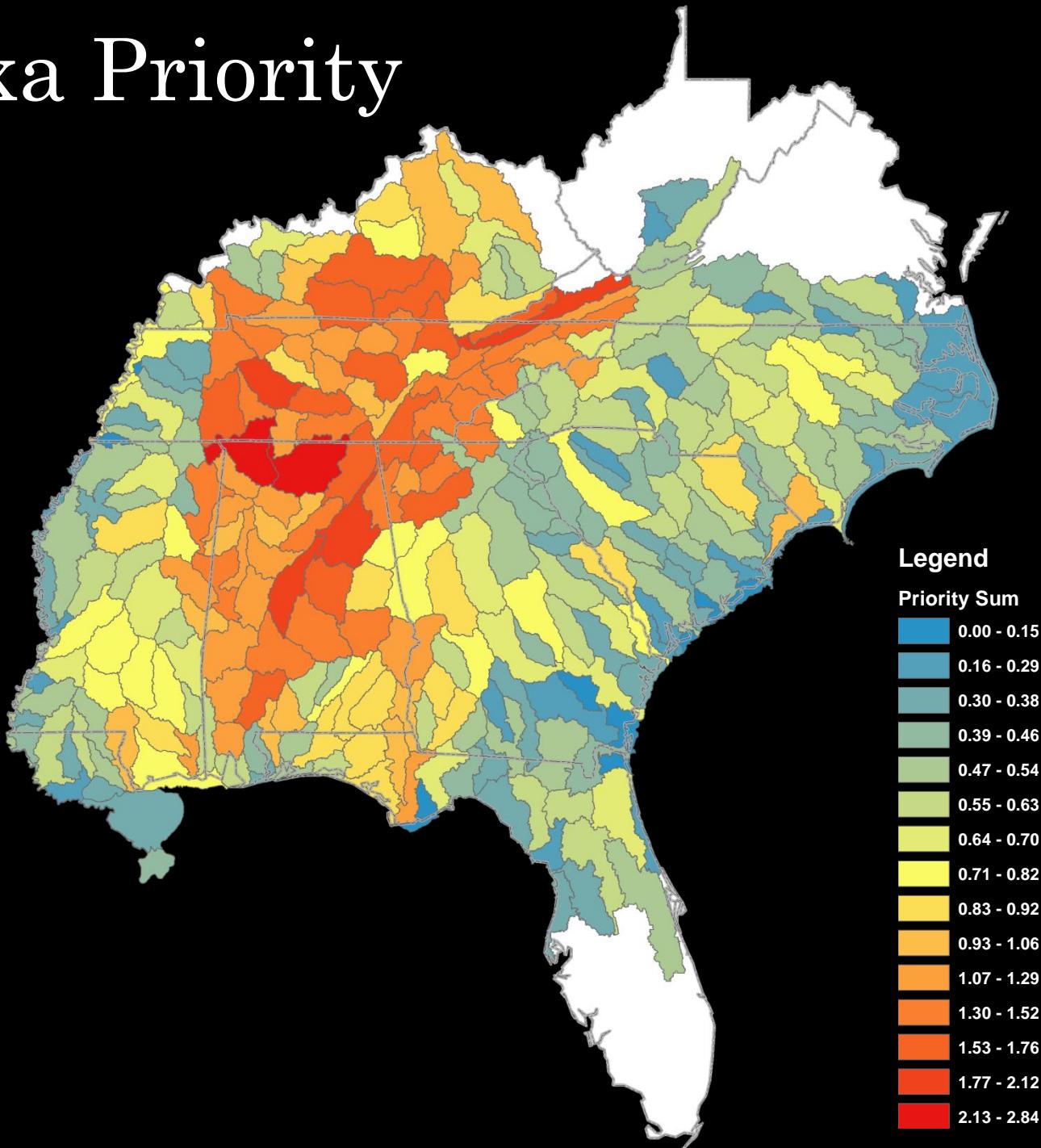
Same data, as points



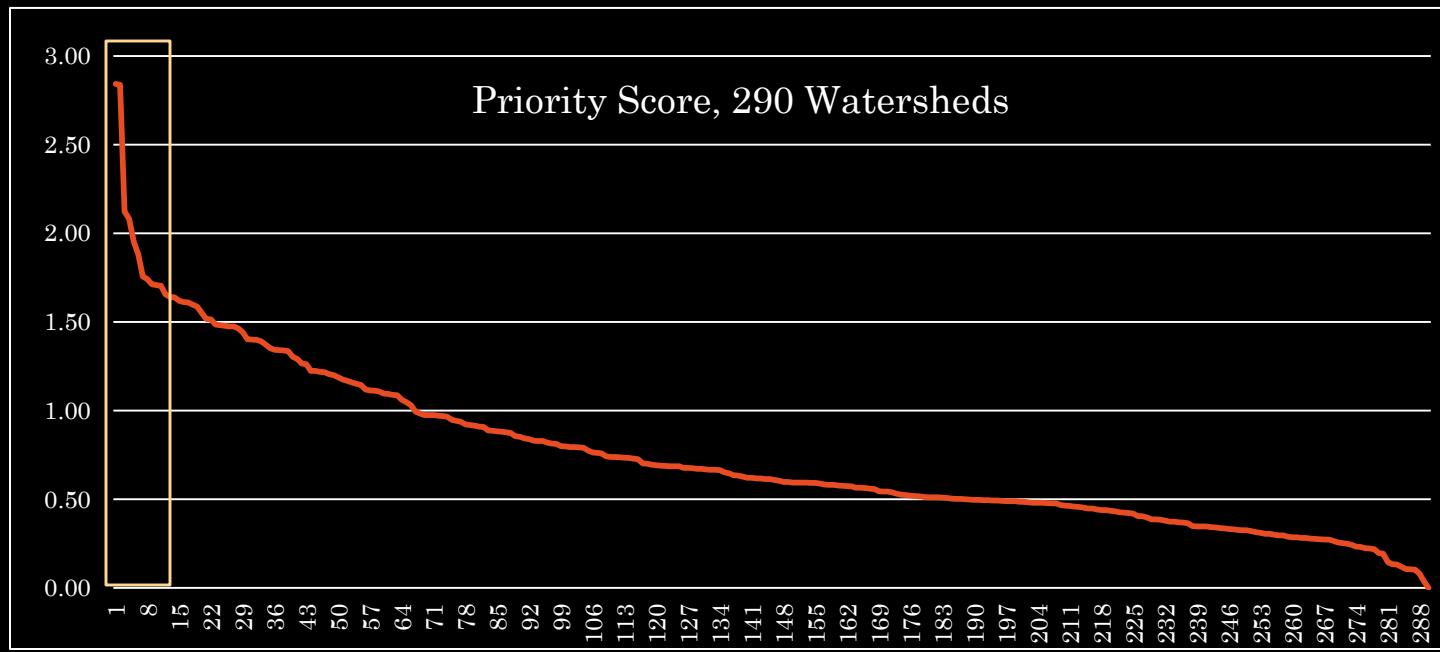
Priority Scores

- Richness, endemism, imperilment each worth keeping
 - How best to combine?
- Advisory committee decided simple sum was best, in absence of compelling argument for a weighing scheme.
 - But acknowledge that there's a weighting scheme in imperilment, already...

All Taxa Priority



Are there tiers?



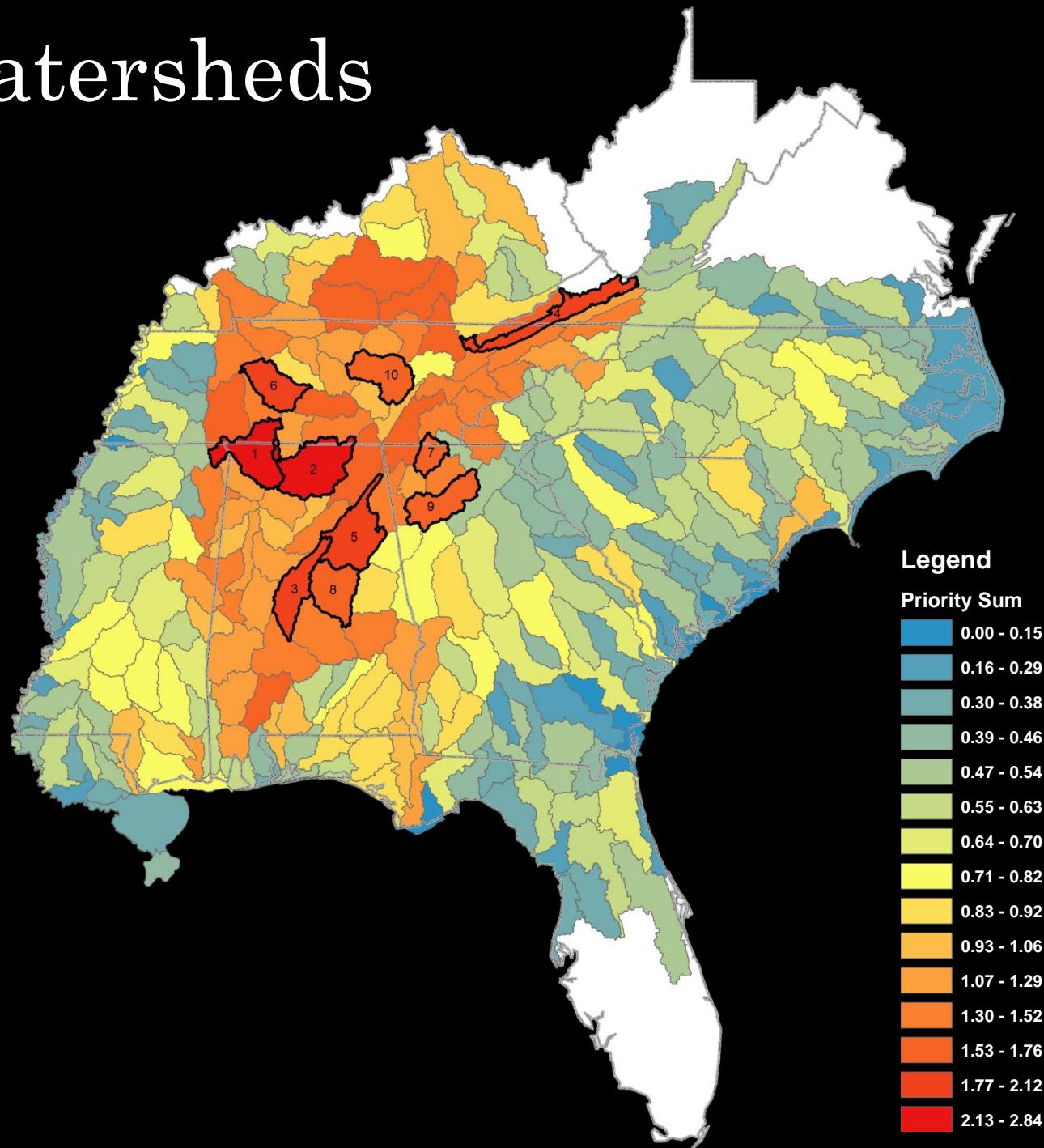
Nod to complementarity

Priority Rank	Priority Score	Sub-basin	Major Drainage	Additional Unique Species
1	2.84	Pickwick Lake	Tennessee	252
2	2.84	Wheeler	Tennessee	22
3	2.12	Cahaba	Alabama	110
4	2.08	Upper Clinch	Tennessee	29
5	1.95	Middle Coosa	Alabama	15
6	1.88	Lower Duck	Tennessee	19
7	1.76	Conasauga	Alabama	9
8	1.74	Lower Coosa	Alabama	2
9	1.71	Etowah	Alabama	16
10	1.71	Caney	Cumberland	21
11	1.70	Barren	Green	26
12	1.66	Upper Green	Green	9
13	1.64	Upper Duck	Tennessee	1

Nod to complementarity

Priority Rank	Priority Score	Sub-basin	Major Drainage	Additional Unique Species
1	2.84	Pickwick Lake	Tennessee	252
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13	1.64	Upper Duck	Tennessee	1

Top Watersheds



Threat Assessment

Threat	Barren	Cahaba	Caney	Conasauga	Etowah	Lower Duck	Mid. Coosa	Pickwick L.	Up. Clinch	Wheeler L
Ag - Livestock	2	1	1		2	1	1	1	1	1
Ag - Row Crops	1	1	2	1		1	1	1	1	1
Forestry		1				2	2	2		
Groundwater Withdrawal						2	1			1
Impoundments/Barriers	2	2	2	2	2	2	2	2	2	2
Industry				2			1			2
Invasive Species								2		2
Land Use Legacies					2					
Mines		1	2				1		1	
Power - Coal Ash					2		2	2		
Power - Other							2			
Reservoir Development					2					
Septic		2								
Sinkhole Dumping									2	
Stormwater Inject. - Karst	1									
Urbanization	1	1	1	2	1	1	1	1	2	1
Wastewater Systems		2	2				1	2		

What Next?

- Report at www.freshwater.org
- Ongoing outreach, Story Map in development
- Refinement of mussel data
- Finer scale analysis of crayfish data
- Would like to extend capacity analysis (not shown here)



Thanks to

- Susie Adams, USFS
- Jason Wisniewski, GA DNR
- Georgia DNR
- Tyler Black, NCWRC
- Jeff Garner, AL DCNR
- Illinois Natural History Survey
- Art Bogan, NCMNS
- Carl Williams, TWRA
- Smithsonian Natural History Museum
- Bob Butler, USFWS
- David Withers, TDEC
- GBIF
- Arnie Eversole, Clemson
- Paul Angermeier VTU
- FishNet2
- Wendell Haag, USFS
- Matt Thomas, KYDFWR
- Kentucky DFWR
- Don Hubbs, TWRA
- Stuart McGregor, GSA
- MARIS
- Bob Jones, MMNS
- Rebecca Bearden, GSA
- Mississippi Museum of Natural Science
- Jess Jones, USFWS/VA Tech
- Katherine Baer, River Network
- North Carolina Museum of Natural Sciences
- Zach Loughman, West Liberty
- Stephanie Chance, USFWS
- Ohio State Univ Museum of Biological Diversity
- Guenter Schuster, GSA
- Tanya Darden, SC DNR
- TVA
- Chris Skelton, HNTB Corporation
- Jessica Graham, SARP
- Bronwyn Williams, NC Museum of Natural Sciences
- Todd Slack, ERDEC
- Mike Harris, USFWS
- Michael LaVoie, Eastern Band Cherokee Indians
- Chris Taylor, INHS
- Pat O'Neil, GSA
- Roger Thoma, Cleveland MNH
- Peggy Shute, USFWS
- Jim Williams, Florida FWCC

Questions?

For further info:

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www.southeastfreshwater.org