National Fish Habitat Partnership

Stream Habitat Assessment 2025 Preliminary Results

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Goals

Review Assessment Approach

Share Preliminary Assessment Results

Share Assessment Applications

Discuss Future Directions

Assessment Approach

Overview of the 2025 Assessment

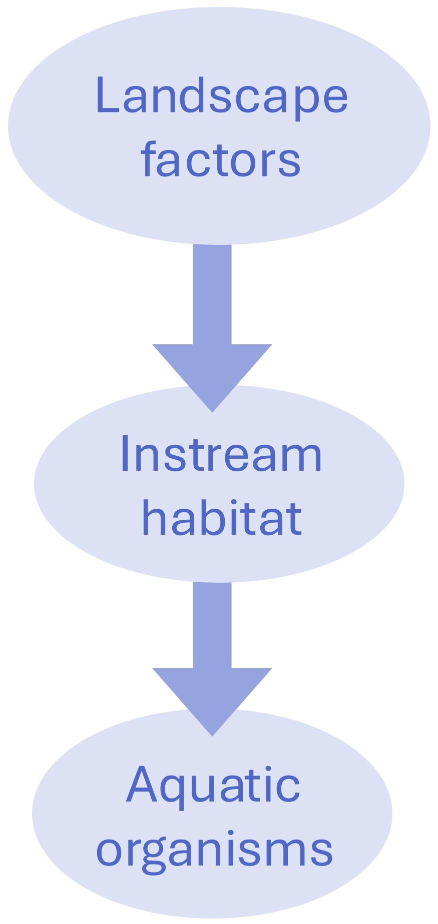
Need	to assess fish habitat condition across the United States
Gap	not feasible to conduct field assessments of fish habitats in every stream
Solution	a landscape approach allows for the approximation of fish habitat

A landscape approach can approximate stream habitat condition

Habitat directly influences fishes found in streams

Natural landscape factors and anthropogenic activities on the landscape affect habitat

Using landscape factors and fish assemblage data, **we can approximate stream habitat condition**



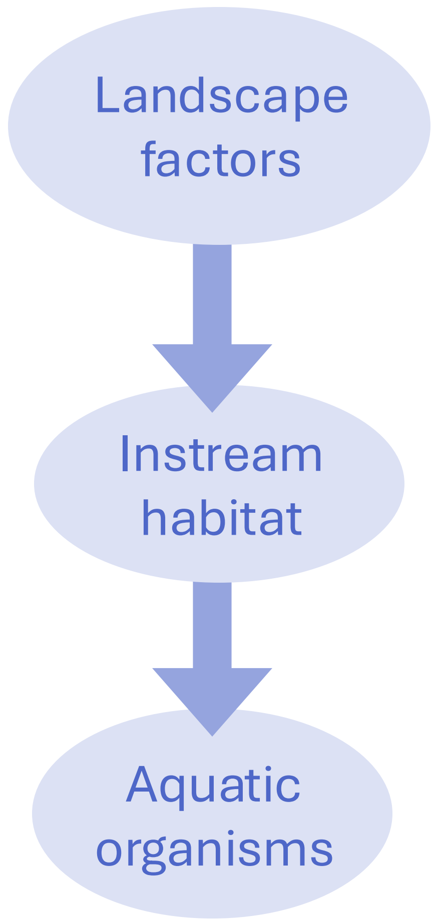
Advantages of a landscape approach for assessing stream fish habitat

Assessment scores are comparable for every stream reach

Inform fisheries management at local, regional, and national scales

Habitat condition is linked to specific disturbances

Inform restoration actions



Lessons learned from the 2015 assessment inform the 2025 assessment

An assessment based on fish metrics limited applicability
Assessment is based on individual species

Analytical steps were time consuming and difficult to replicate
Analysis is more efficient and repeatable

One cumulative condition score was difficult to interpret
Provide condition score based on groups of disturbances

Some key disturbances were missing from assessment
Many additional important disturbances are included

Lacked capacity to communicate opportunities to use assessment results
Highlight several applications of assessment results

Key Elements of the 2025 Assessment Approach

1. Assemble data
2. Integrate into spatial framework
3. Control for natural variation
4. Identify limiting disturbances
5. Create and apply scores

2015 and 2025 Assessments are **Not Directly Comparable**

1. Assemble data	New fish species and new disturbance variables
2. Integrate into spatial framework	Different spatial framework: NHD Plus V1 vs V2
3. Control for natural variation	
4. Identify limiting disturbances	Species based rather than metric based
5. Create and apply scores	Improved scoring protocol

Step 1. Assemble Data

Three types of data

Stream fish assemblages

Natural landscape factors

Anthropogenic disturbances

Stream fish assemblage data

84 providers

(13 new sources)

- Alabama Department of Conservation and Natural Resources
- Alabama Department of Environmental Management
- Arizona Game and Fish
- Arkansas Department of Environmental Quality
- BioData
- City of Elkhart
- Colorado Division of Parks and Wildlife
- Connecticut Department of Energy and Environmental Protection
- Delaware Department of Natural Resources and Environmental Control
- Florida Fish and Wildlife Conservation Commission
- Geological Survey of Alabama
- Georgia Department of Natural Resources
- Idaho Department of Environmental Quality
- Idaho Department of Fish and Game
- Illinois Department of Natural Resources
- Indiana Department of Environmental Management
- Iowa Department of Natural Resources
- Kansas Department of Wildlife and Parks
- Kentucky Division of Water
- Lake Superior State University
- Louisiana Department of Environmental Quality
- Louisiana Department of Wildlife and Fisheries
- Louisiana State University
- Maine Department of Environmental Protection
- Maine Department of Inland Fisheries and Wildlife
- Maryland Department of Natural Resources
- Massachusetts Department of Fisheries and Wildlife
- Michigan Department of Natural Resources
- Michigan Department of Environment, Great Lakes, and Energy
- Michigan State University
- Minnesota Pollution Control Agency
- Mississippi Department of Wildlife Fisheries and Parks
- Mississippi Museum of Natural History
- Montana Department of Fish, Wildlife and Parks
- Museum of Southwestern Biology
- Nebraska Game and Parks Commission
- Nebraska Regional Environmental Monitoring and Assessment Program
- Nevada Department of Wildlife
- New Hampshire Fish and Game
- New Jersey Division of Fish and Wildlife
- New Mexico Department of Game and Fish
- New York State Department of Environmental Conservation
- North Carolina Inland Fisheries Division
- North Carolina Division of Water Quality
- North Dakota Department of Environmental Quality
- North Dakota Fish and Game
- Ohio Environmental Protection Agency
- Oklahoma Conservation Commission
- Pennsylvania Fish and Boat
- RivFishTIME
- South Carolina Department of Natural Resources
- South Dakota Game, Fish and Parks
- Southeast Aquatic Resources Partnership
- Tarleton State
- Tennessee Wildlife Resources Agency
- Texas Parks and Wildlife
- Troy University
- University of Southern Mississippi
- University of Wyoming
- U.S. EPA National River and Streams Assessment
- U.S. EPA Regional EMAP
- U.S. Geological Survey
- U.S. Geological Survey – Adirondack
- U.S. Geological Survey – Upper Midwest
- U.S. Forest Service
- Utah Division of Wildlife Resources
- Vermont Division of Wildlife Resources
- Vermont Fish and Wildlife Department
- Virginia Department of Game and Inland Fisheries
- Virginia Department of Environmental Quality
- Virginia Department of Wildlife Resources
- Washington Department of Ecology
- Wisconsin Department of Natural Resources
- West Virginia Department of Environmental Protection

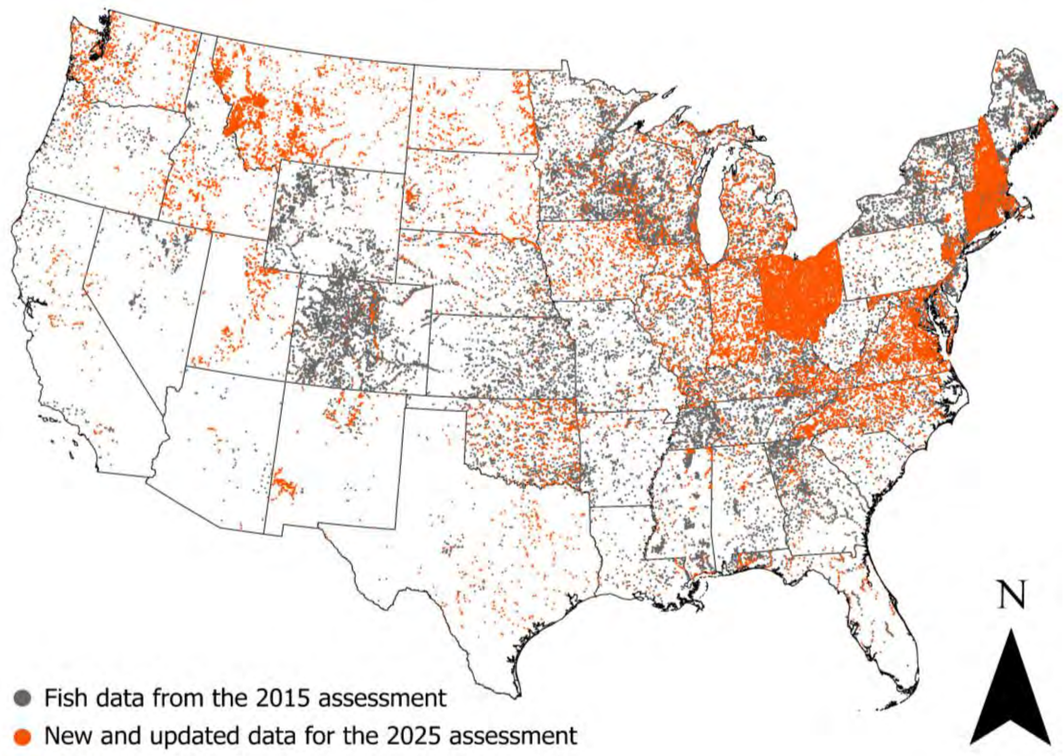
Stream fish assemblage data

84 providers
(13 new sources)

51,382 stream reaches
(11,977 new reaches)

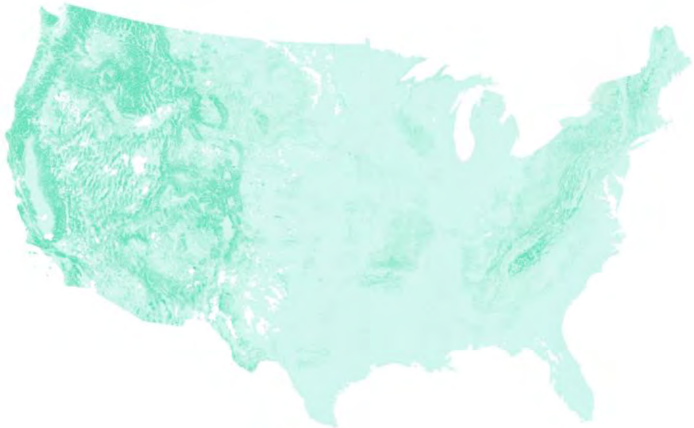
783 species
(57 new species)

All community samples
collected with single-pass electrofishing
from 2000-2024



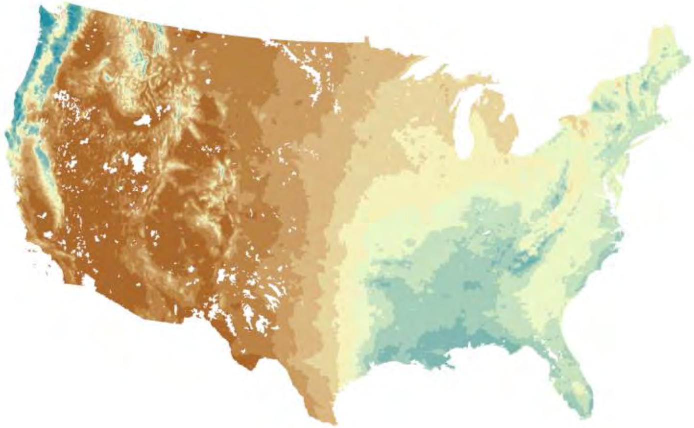
Natural landscape factors

Maximum Reach Elevation (NHD)

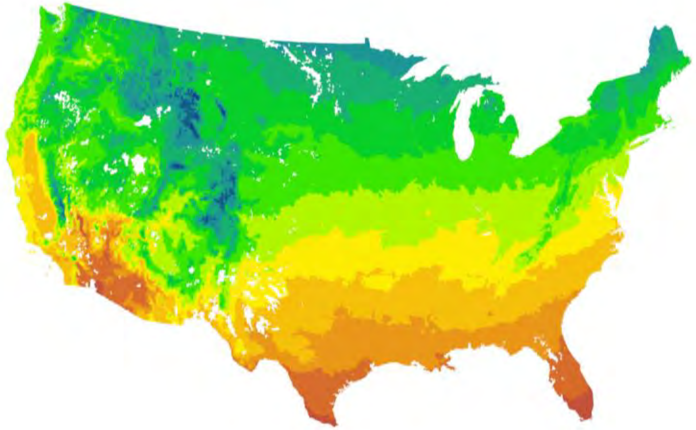


Mean Reach Slope (NHD)

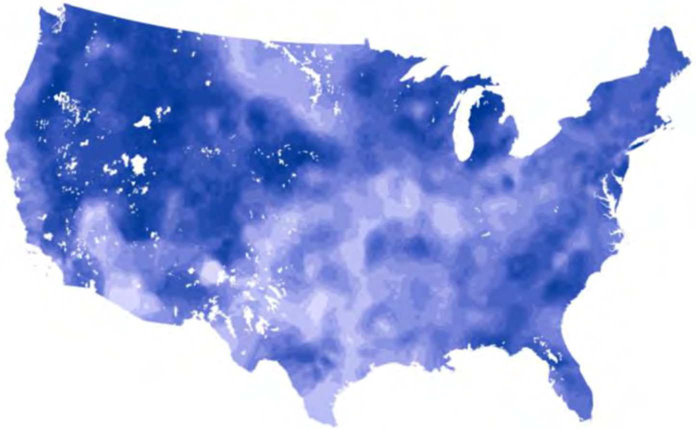
Total Drainage Area (NHD)



Mean Annual Precipitation (PRISM)



Mean Annual Air Temperature (PRISM)



Groundwater Baseflow Index (USGS)

Anthropogenic disturbances
included in preliminary assessment results

Land Cover	Fragmentation	Water Quality
Urban land cover (% area)	Downstream mainstem dam density (#/100km)	Nitrogen fertilizer used (kg/km^2/yr)
Impervious surface (% area)	Upstream degree of regulation (% flow stored)	Phosphorus fertilizer used (kg/km^2/yr)
Population density (#/km^2)	Upstream mainstem dam density (#/100km)	Suspended sediment load (MT/yr)
Agricultural land cover (% area)	SARP road crossing density (#/km^2)	Total nitrogen load (kg/yr)
	Road density (km/km^2)	Total phosphorus load (kg/yr)
	SARP barrier density (#/km^2)	Septic system density (#/km^2)
		Estimated road salt spread (kg/km^2/yr)
		Net anthropogenic nitrogen (kg/ha/yr)
orange = new to assessment		Wastewater treatment plant density (#/km^2)

Anthropogenic disturbances
to be tested and included

Will be incorporated:

Mine density (USGS)

Point source pollution (EPA)

Water withdrawals (USGS)

Are being tested:

Hydrologic alteration (McManamay et al. 2022)

Boat launch density (USGS)

Wildfire burn area (USGS)

Timber harvest (USGS)

Grazing (USGS)

Tile drainage (USGS)

Drought severity (NOAA)

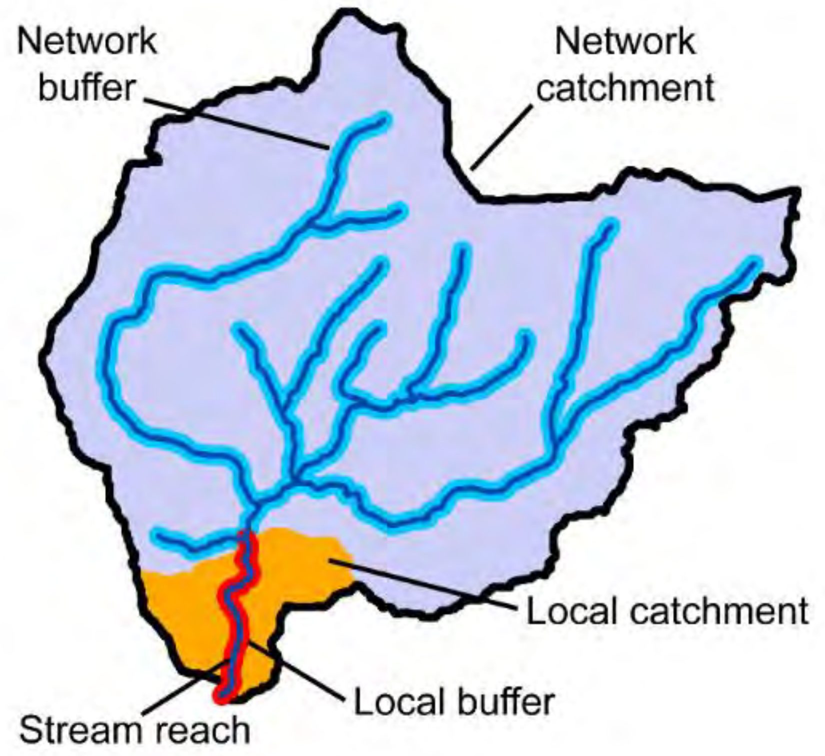
Step 2. Integrate into Spatial Framework

Framework derived from NHD Plus V2

Stream fish community data linked to stream reaches

Landscape variables summarized over four spatial extents

- Local catchment
- Local buffer
- Network catchment
- Network buffer



Ross et al. 2023

Step 3. Control for Natural Variation

Ecoregions have similar environmental characteristics

Constrained analyses within 9 U.S. EPA ecoregions

Grouped sites into size classes

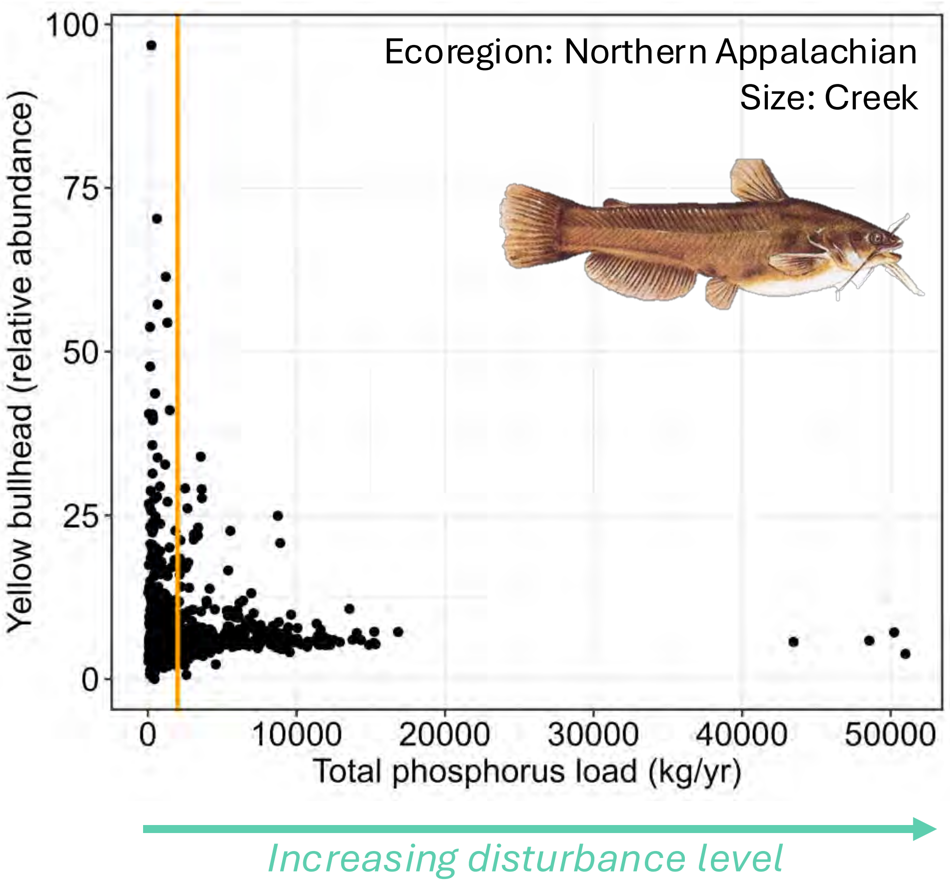
- Creeks (catchment area <100 km^2)
- Rivers (catchment area >100 km^2)

Control for natural variation in fish assemblages using natural landscape variables

Assemble data → Integrate into spatial framework → **Control for natural variation** → Identify limiting disturbances → Create and apply scores

Step 4. Identify Limiting Disturbances

A limiting disturbance is associated with a negative threshold response



Assemble data | Integrate into spatial framework | Control for natural variation | Identify limiting disturbances | Create and apply scores

Step 4. Identify Limiting Disturbances

We test and identify limiting disturbances
for every species
that occurred in at least 40 stream reaches

Using individual species, as opposed to fish metrics, is an improvement from the 2015 assessment made possible by improved and streamlined analysis

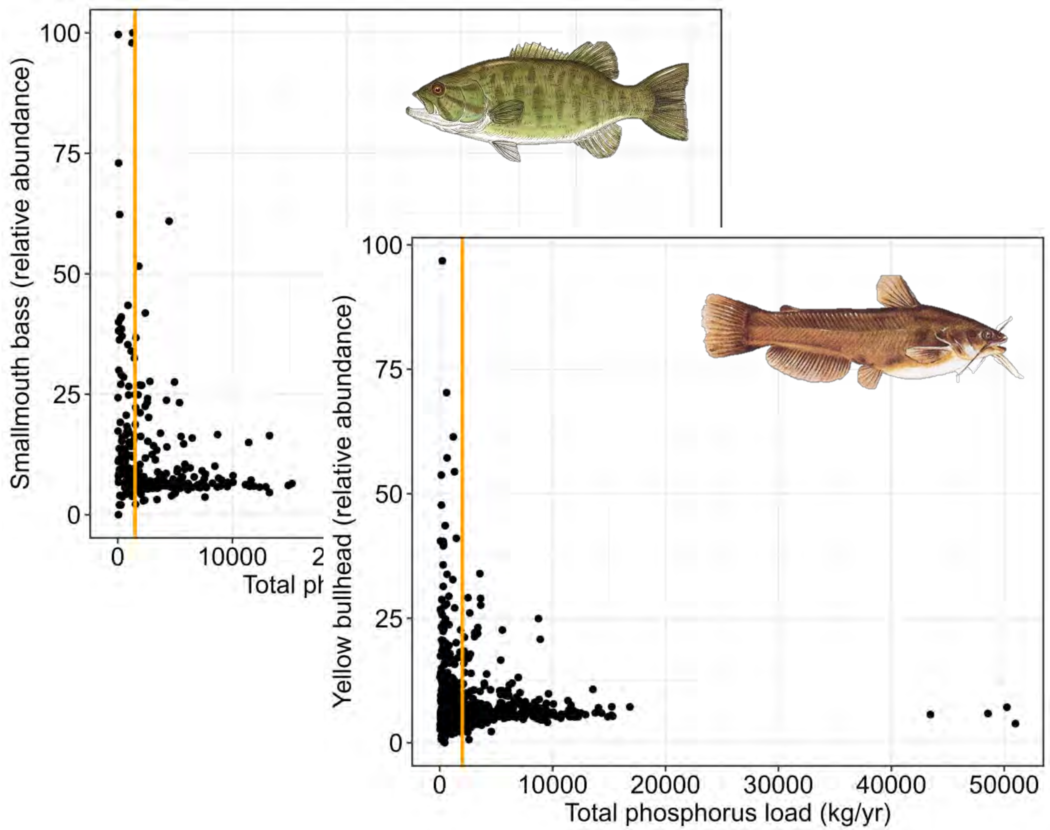
Step 5. Create and Apply Scores

I. Create scores for each limiting disturbance
II. Create sub-index scores
III. Create cumulative condition score

I. Create scores for each limiting disturbance

Scored stream reaches for every limiting disturbance

The two **best classes** were determined with the **highest and lowest species-specific thresholds**



Assemble data | Integrate into spatial framework | Control for natural variation | Identify limiting disturbances | Create and apply scores

I. Create scores for each limiting disturbance

Scored stream reaches for every limiting disturbance

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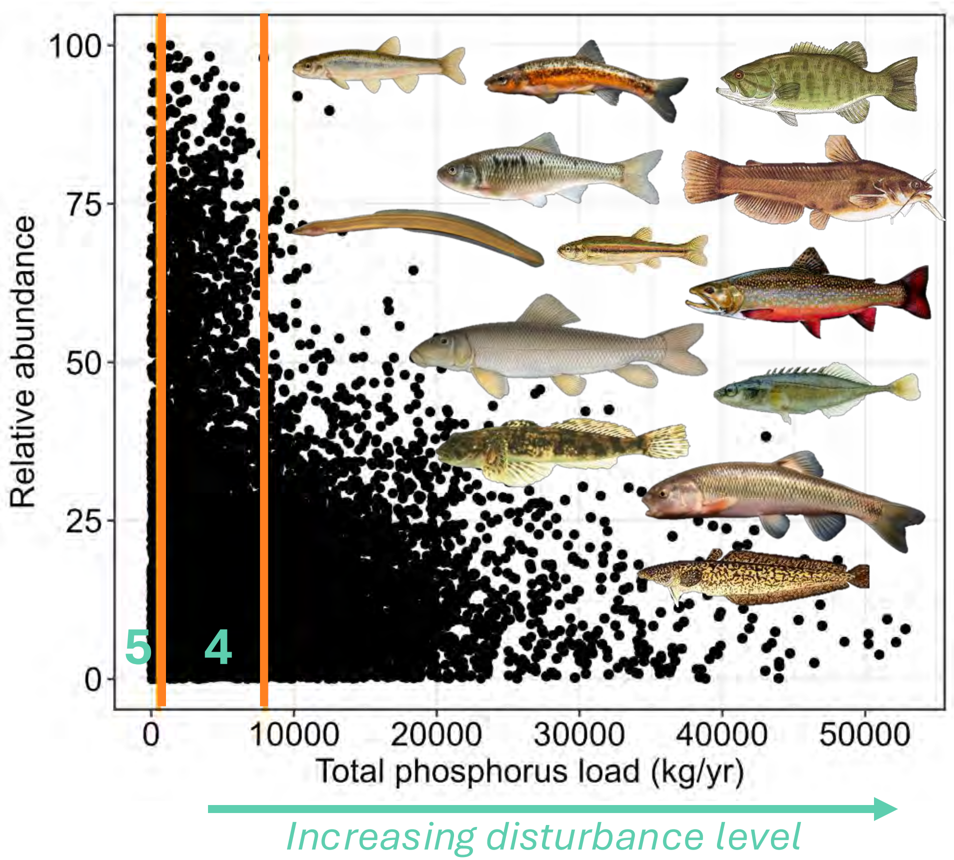
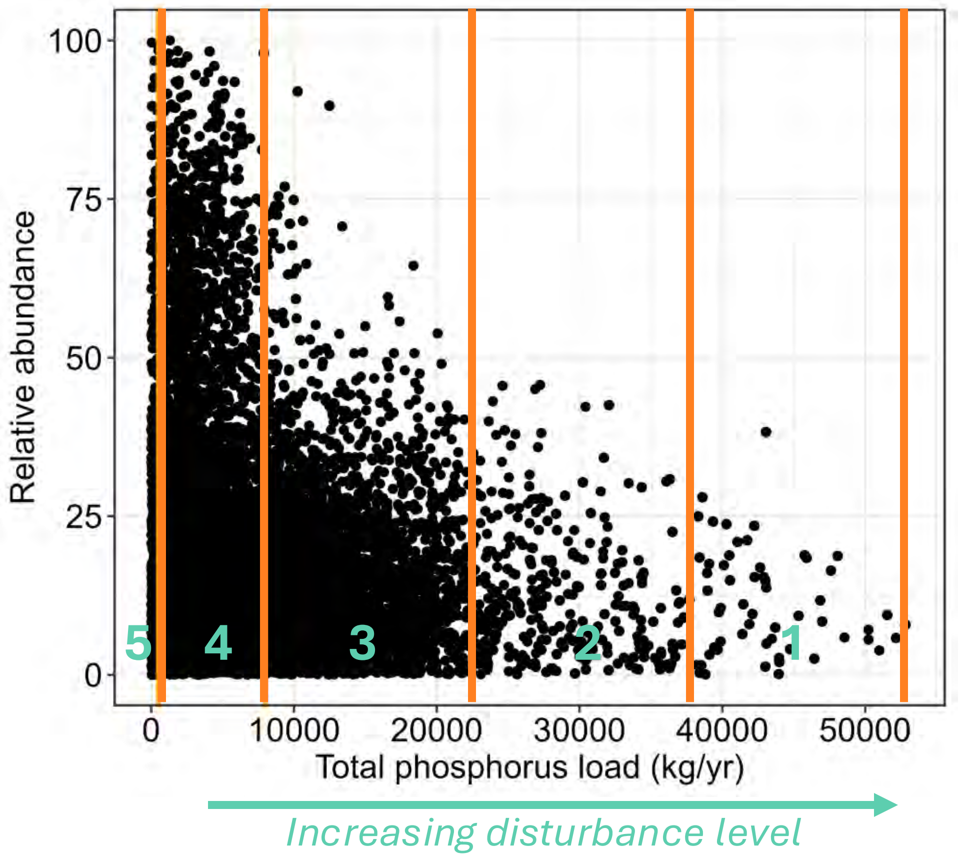


I. Create scores for each limiting disturbance

Scored stream reaches for every limiting disturbance

The two **best classes** were determined with the **highest and lowest species-specific thresholds**

The three **remaining classes** were determined by equally dividing the range between the **highest disturbance level and the highest threshold**



II. Create sub-index scores

Three sub-indices (so far):

Land Use	Fragmentation	Water Quality
Urban land cover (% area)	Downstream mainstem dam density (#/100km)	Nitrogen fertilizer used (kg/km^2/yr)
Impervious surface (% area)	Upstream degree of regulation (% flow stored)	Phosphorus fertilizer used (kg/km^2/yr)
Population density (#/km^2)	Upstream mainstem dam density (#/100km)	Suspended sediment load (MT/yr)
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	SARP barrier density (#/km^2)	Septic system density (#/km^2)
		Estimated road salt spread (kg/km^2/yr)
		Net anthropogenic nitrogen (kg/ha/yr)
		Wastewater treatment plant density (#/km^2)

II. Create sub-index scores

Each sub-index score is the
minimum of the disturbance variable scores

Example: Water Quality Sub-index

Reach	Total N Load	Total P Load	Road Salt	Score
112	4	4	1	**1**
113	3	2	2	**2**

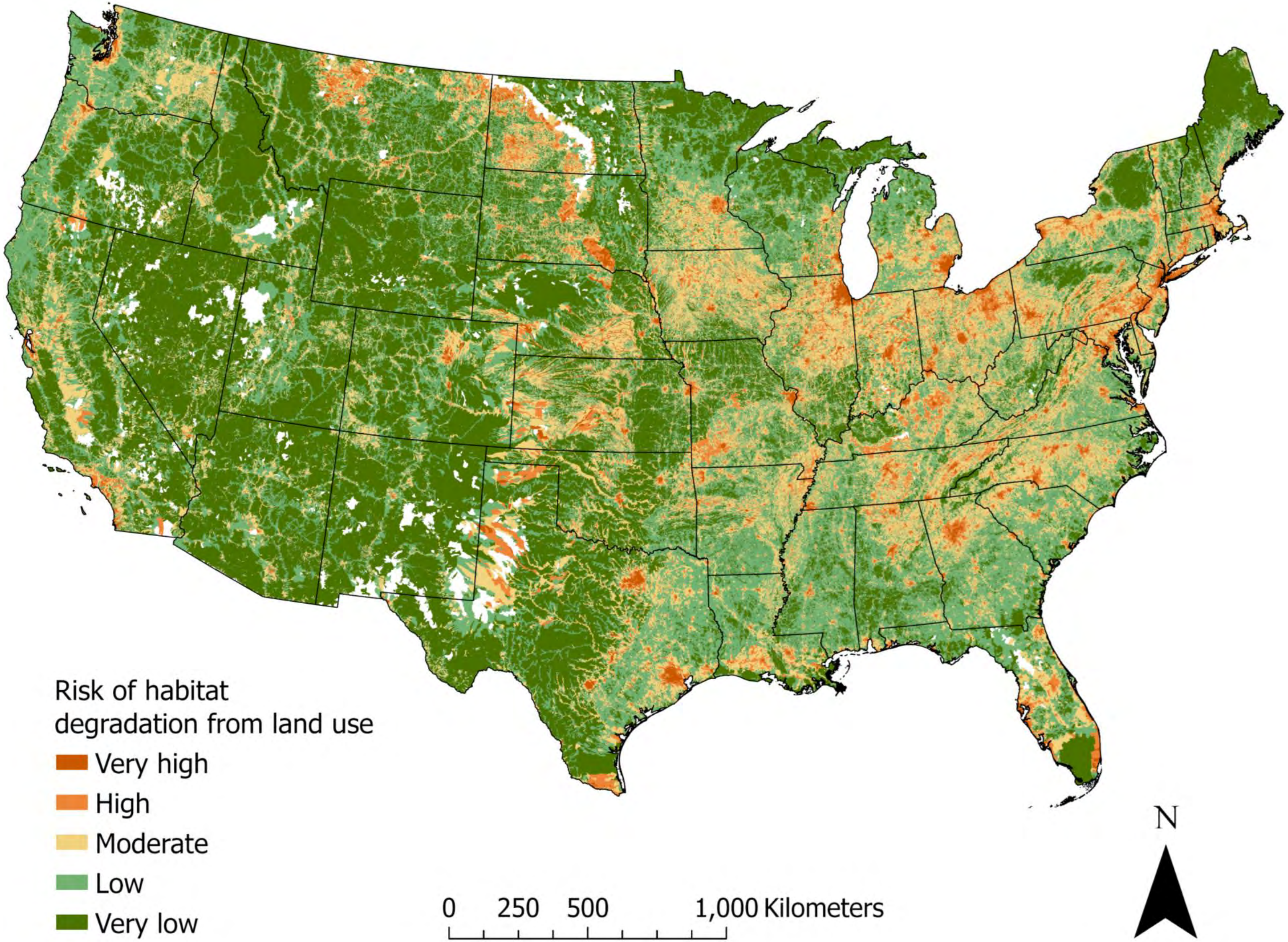
III. Create cumulative condition scores

The overall condition score for each stream reach
is the **minimum of the sub-index scores**

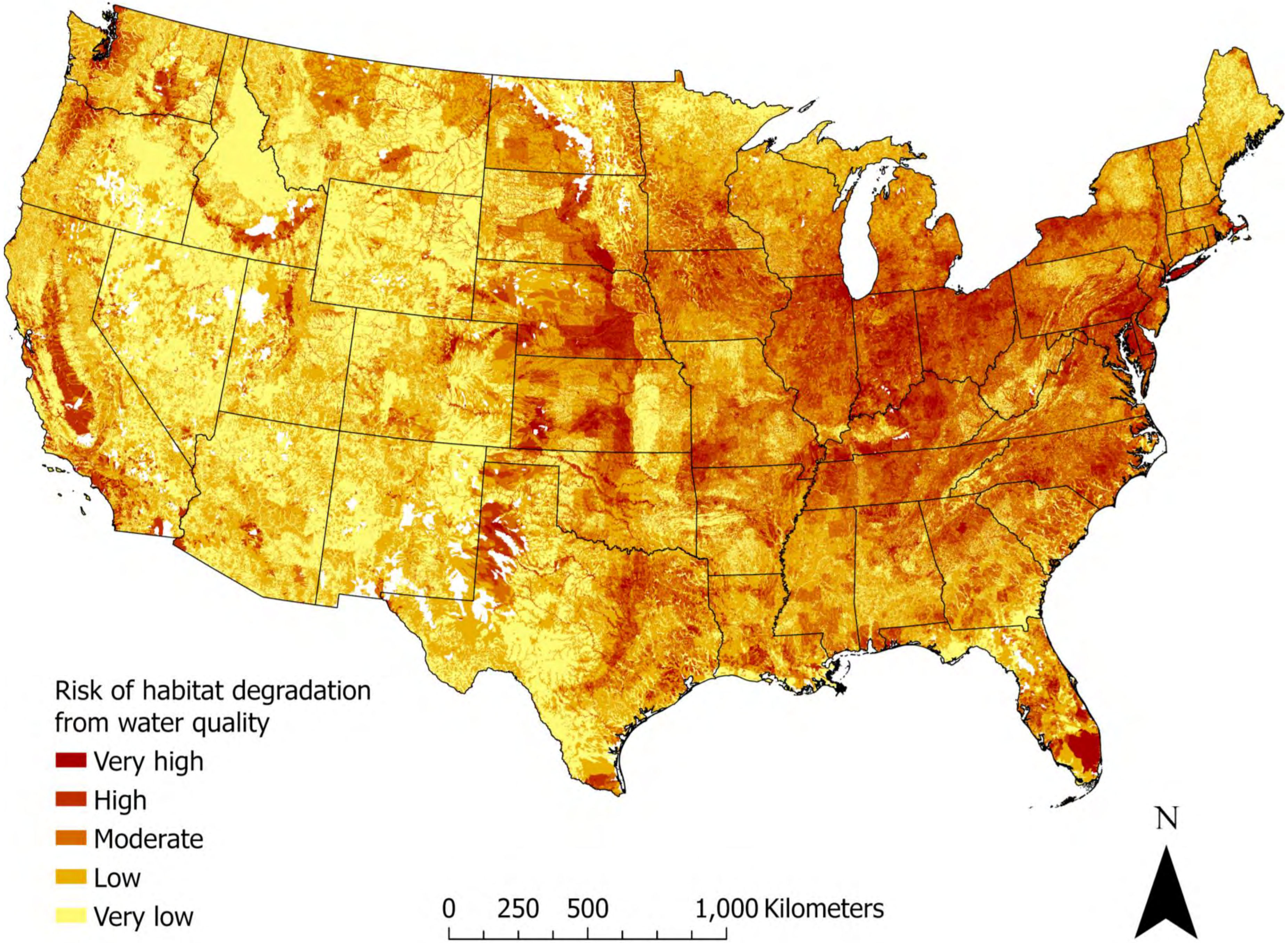
Reach	Land Use	Water Quality	Fragmentation	Overall Condition Score
112	3	2	4	**2**
113	5	4	3	**3**

Preliminary Assessment Results

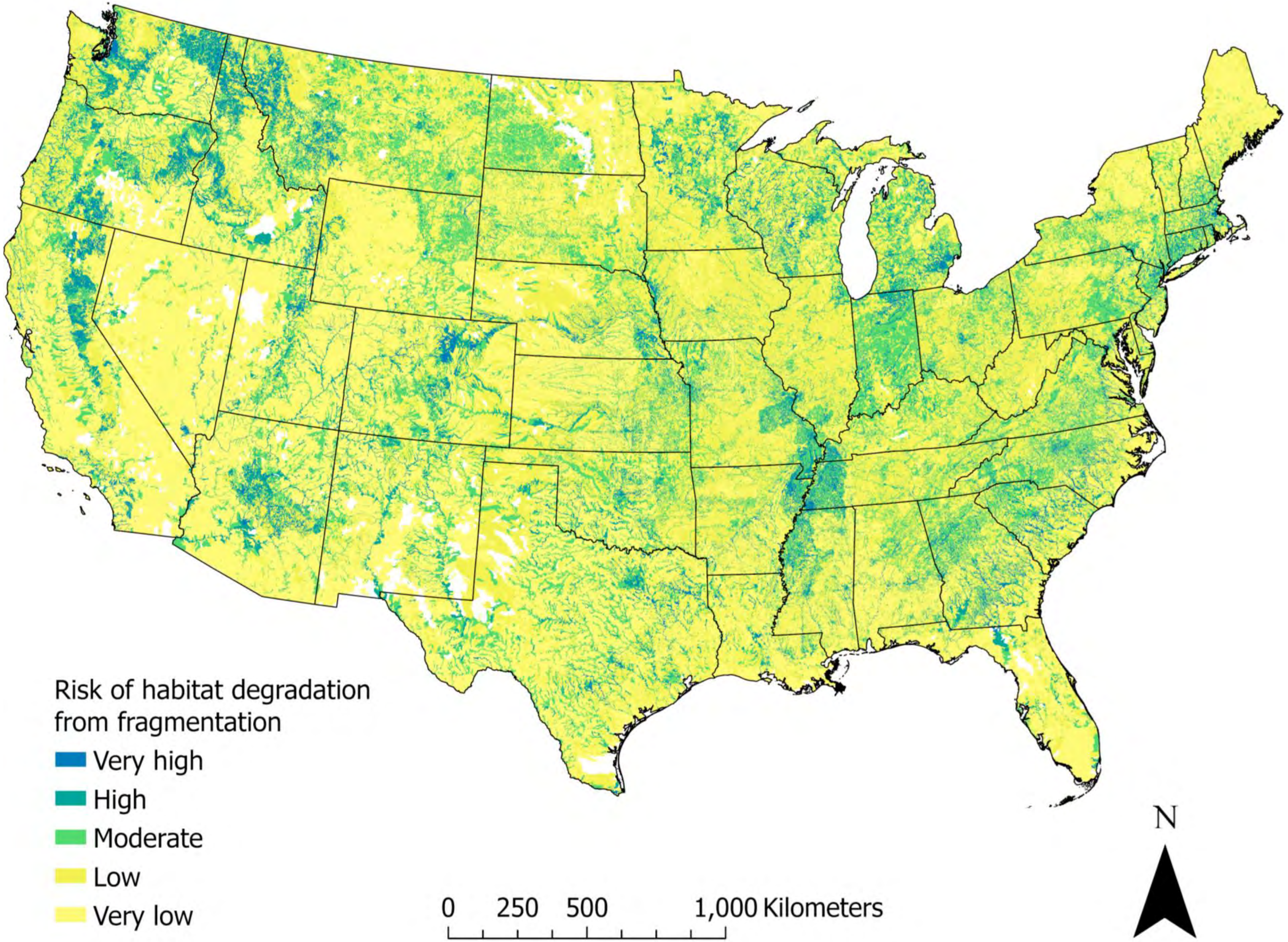
SUB-INDEX RESULTS: Land use



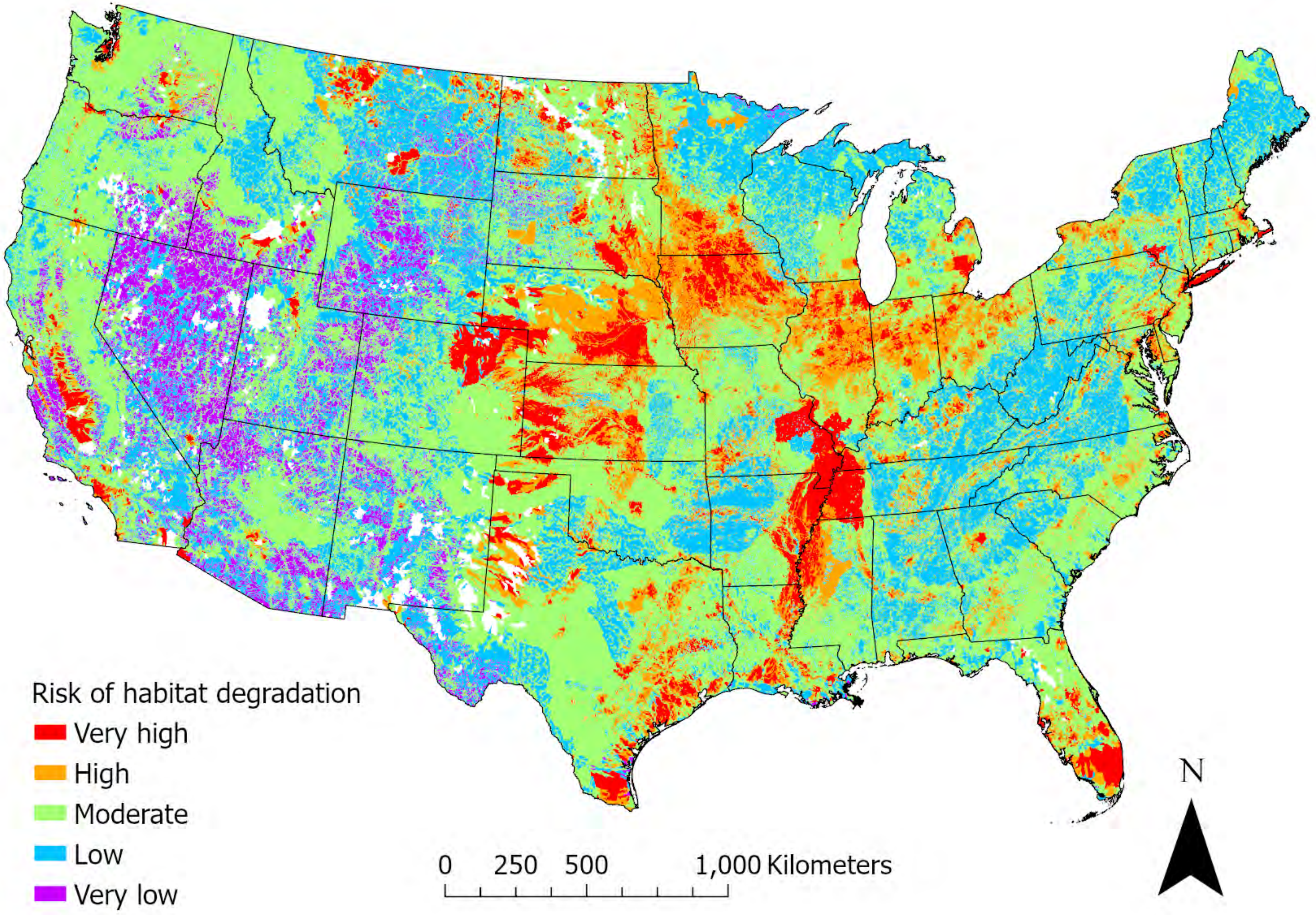
SUB-INDEX RESULTS: Water quality



SUB-INDEX RESULTS: Fragmentation

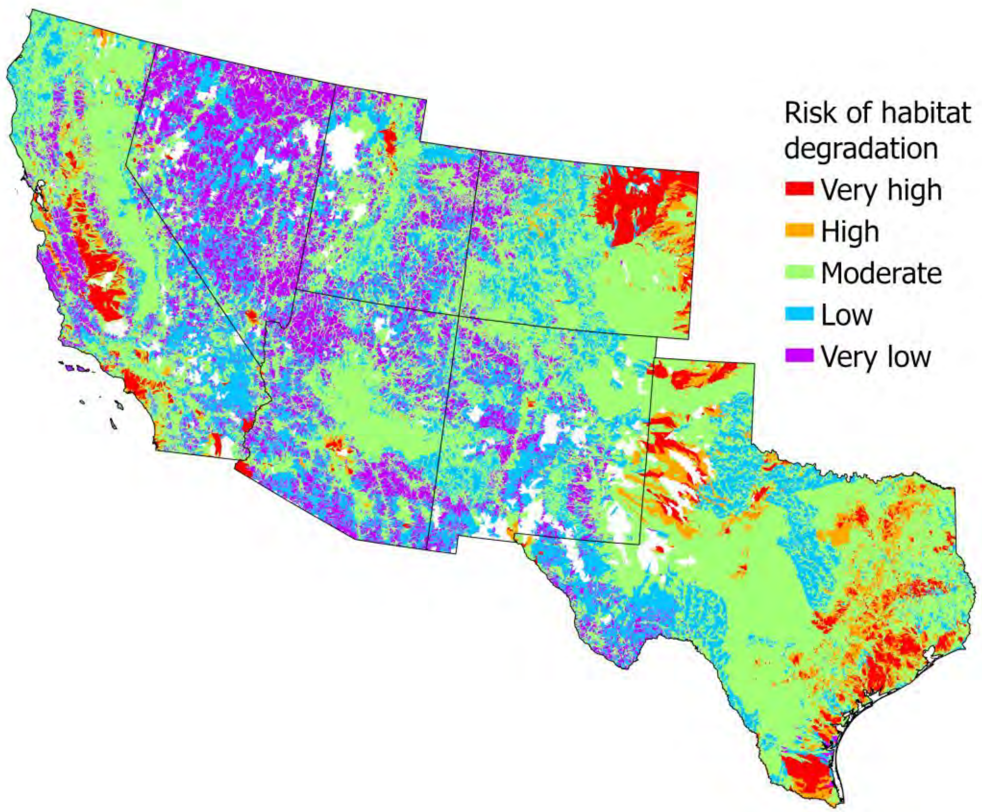


CUMULATIVE CONDITION SCORE

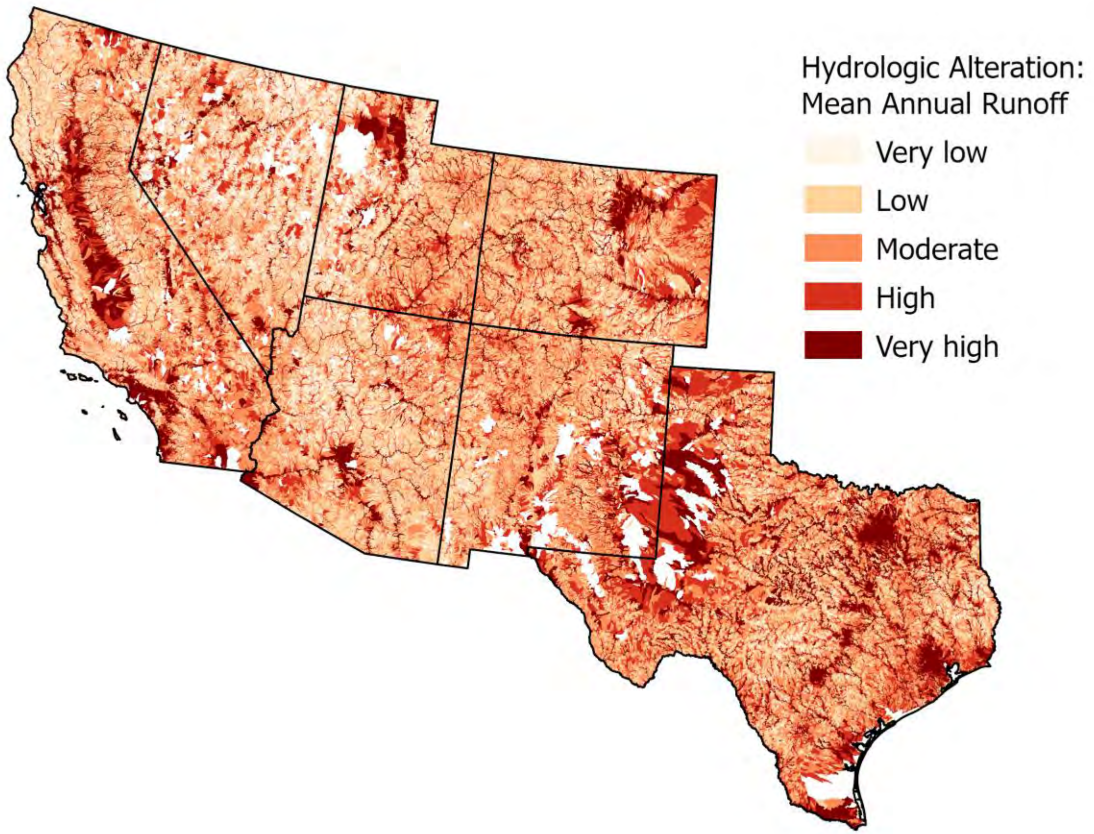


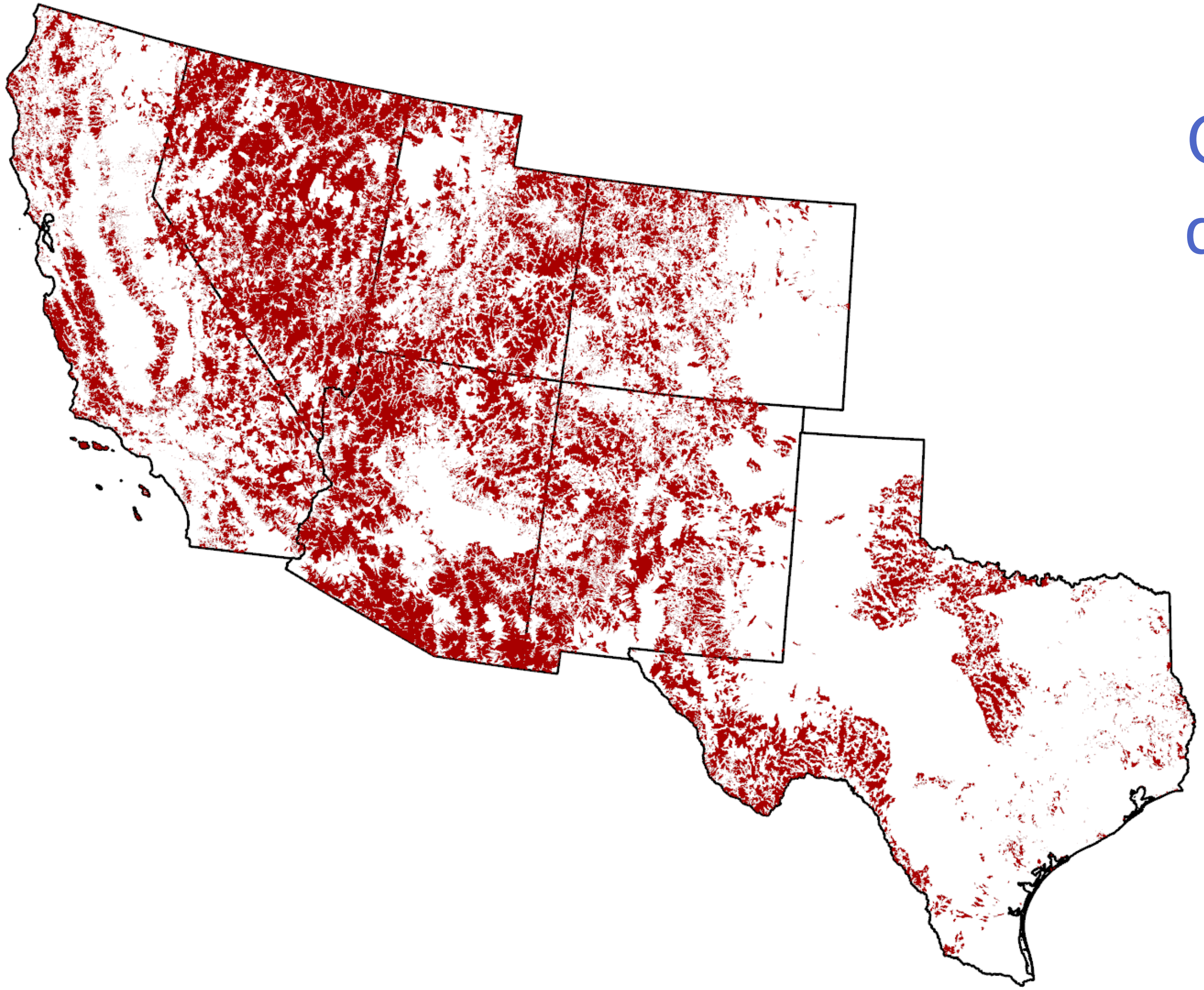
Additional Disturbance Variables Are Likely to Change Condition Scores

Current cumulative condition



Being tested to include in assessment





Catchments where risk of habitat degradation may **increase** due to hydrologic alteration

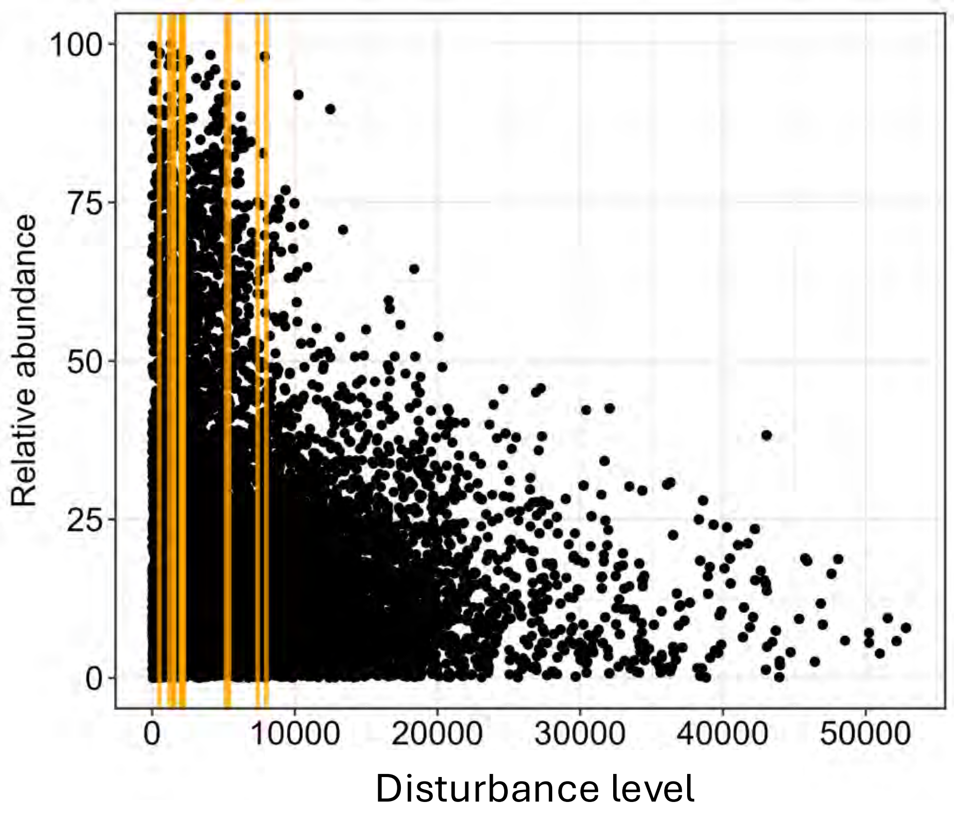
Low or Very Low
Risk of Habitat Degradation
+
Moderate, High, or Very High
Hydrologic Alteration: Mean Annual Runoff

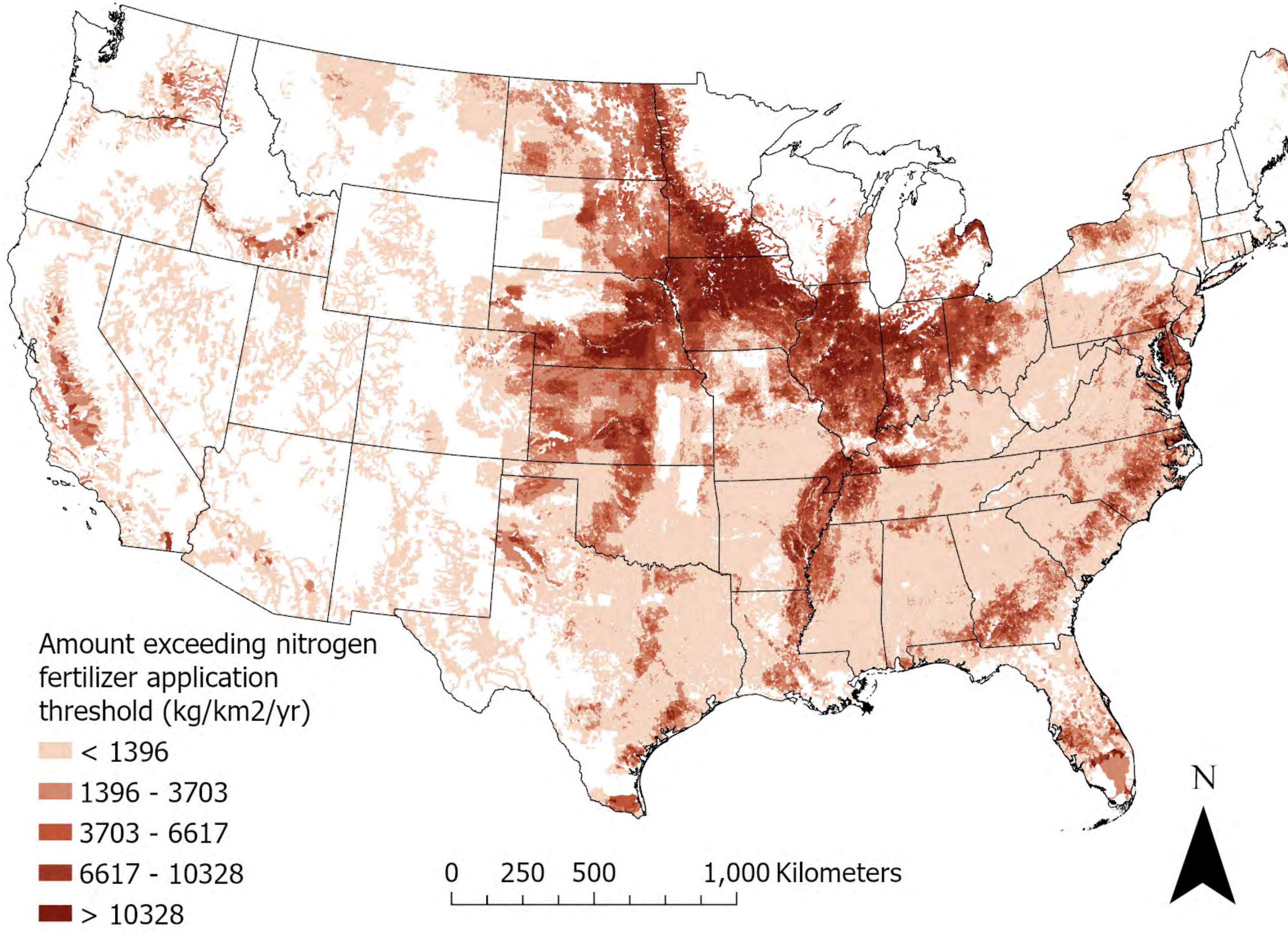
Applications

Applications of 2025 NFHP Assessment Results

There are many ways to use the 2025 NFHP Assessment results

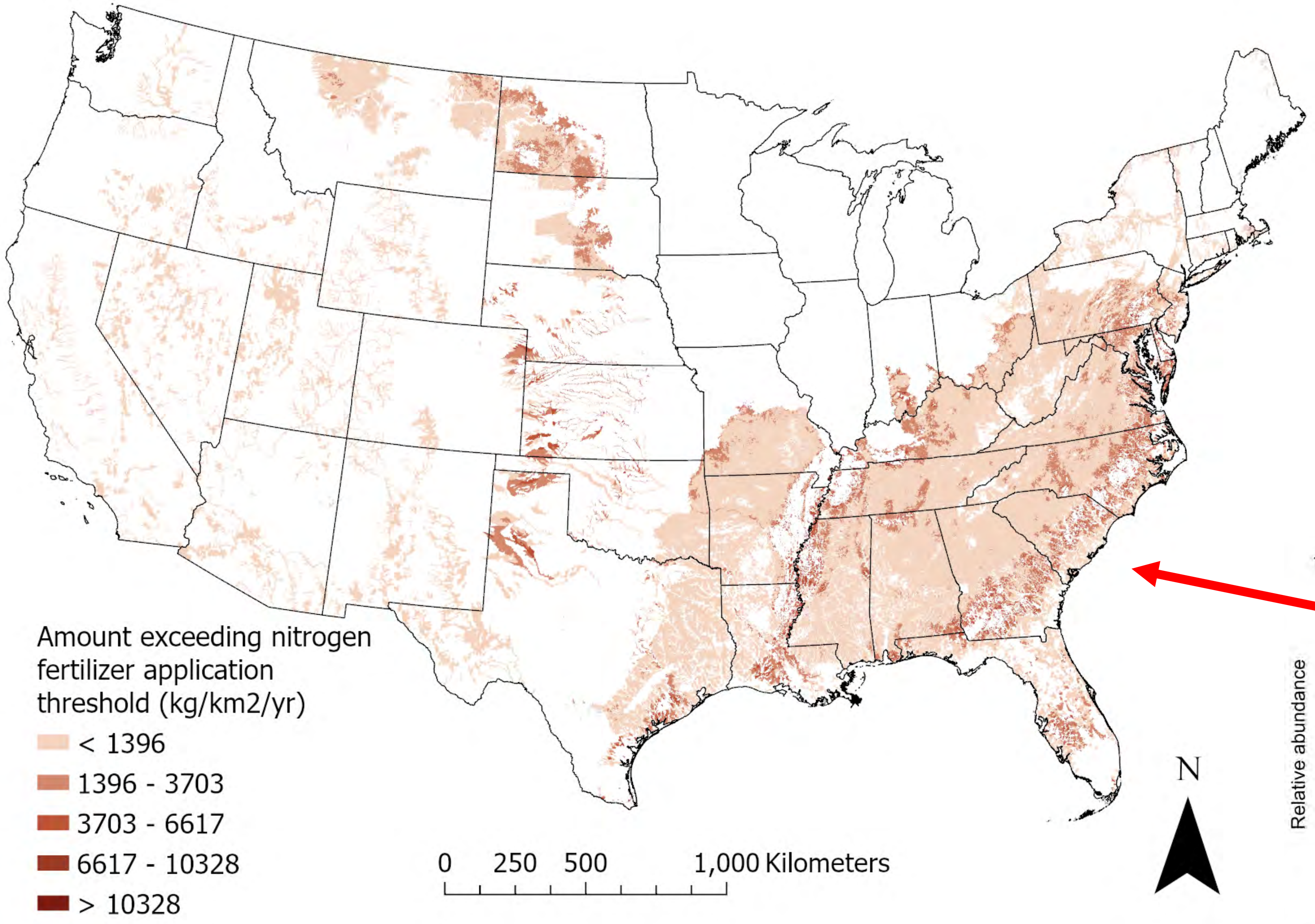
- Use threshold values of individual disturbances

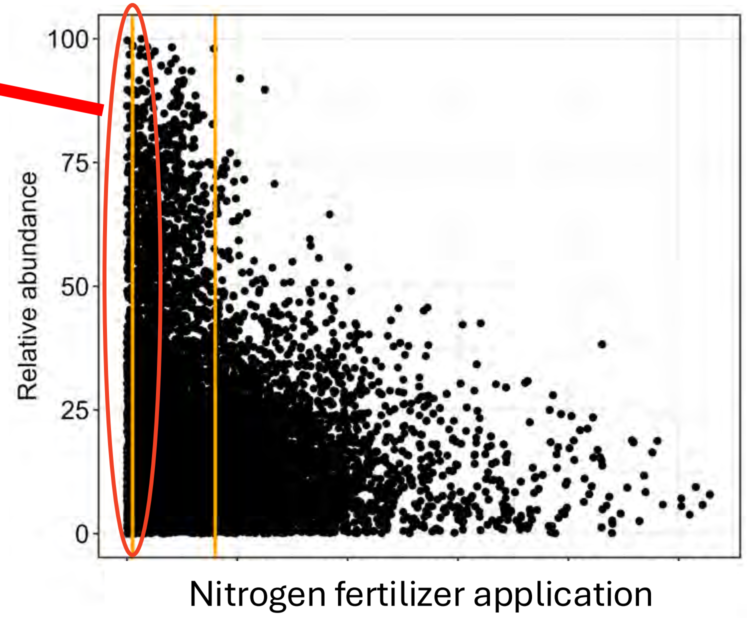




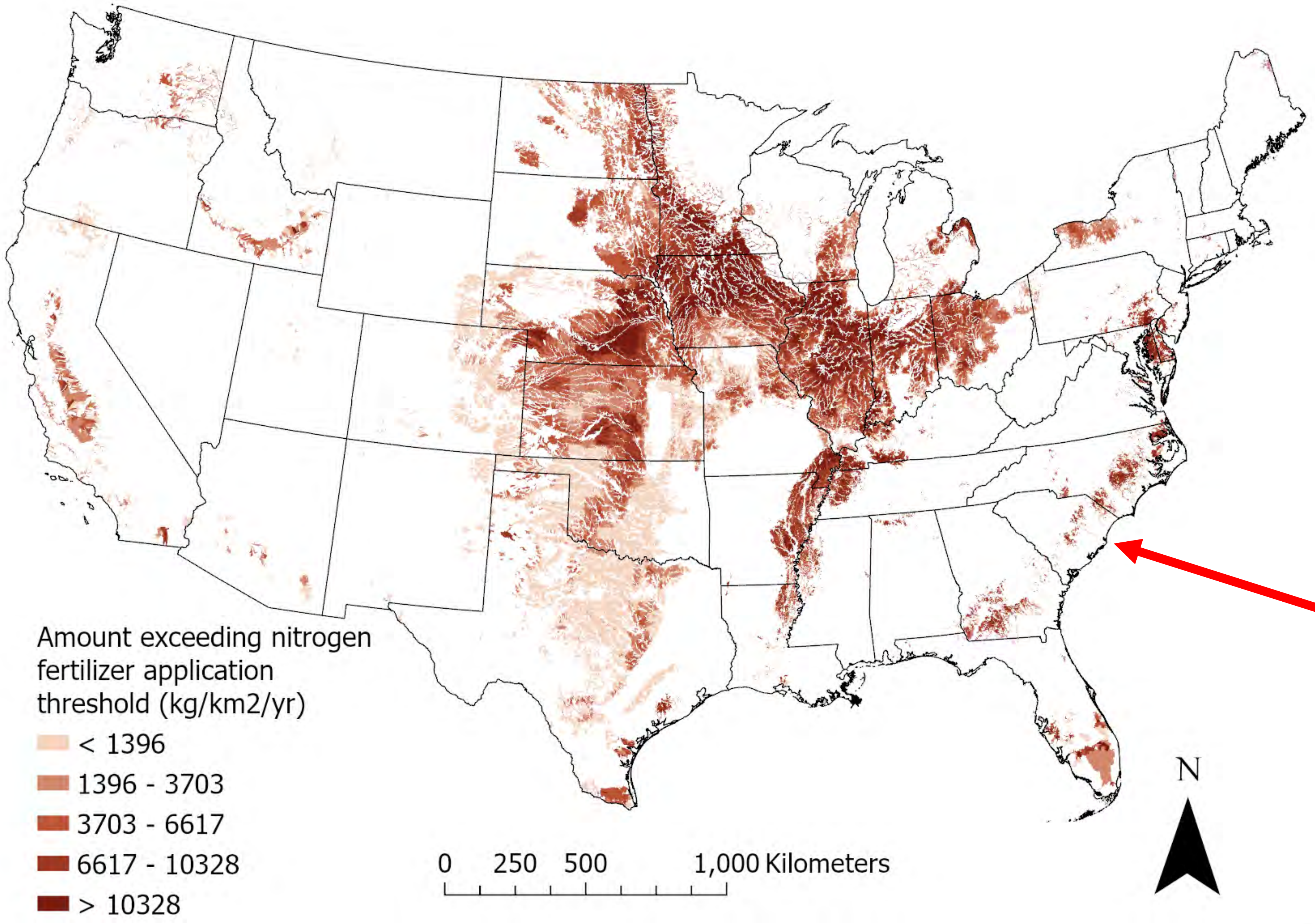
Where are stream fishes limited by nitrogen fertilizer applications and by how much?

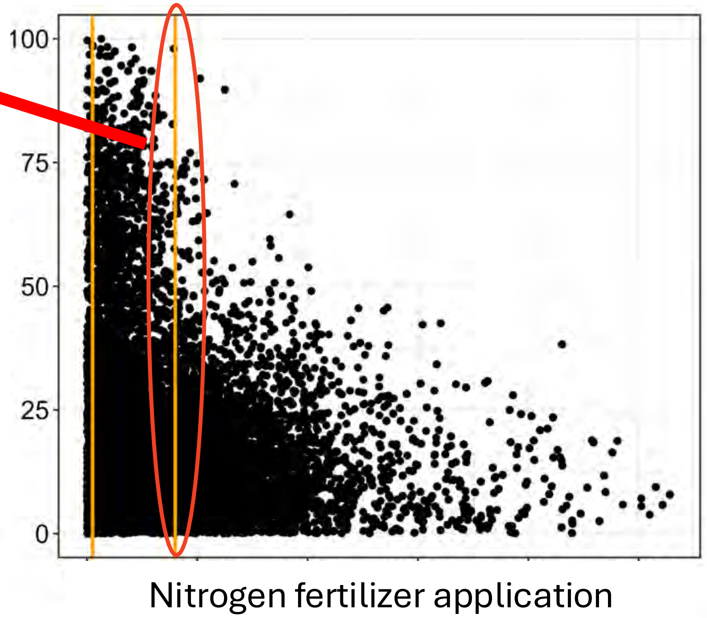
Limited by nitrogen fertilizer applications but still at low risk of degradation

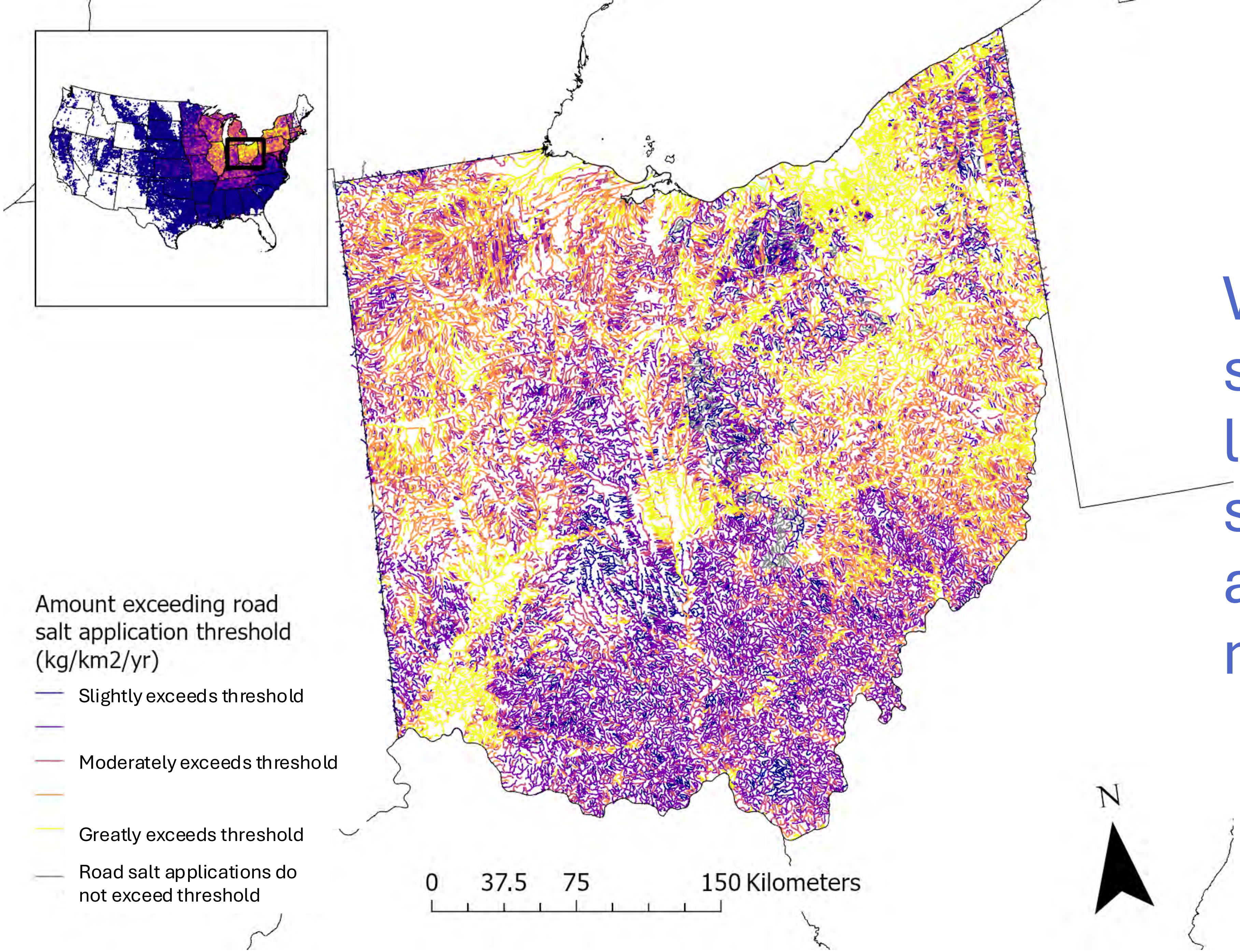




Limited by nitrogen fertilizer applications resutling in moderate to high risk of degradation







Where are stream fishes limited by road salt applications and by how much?

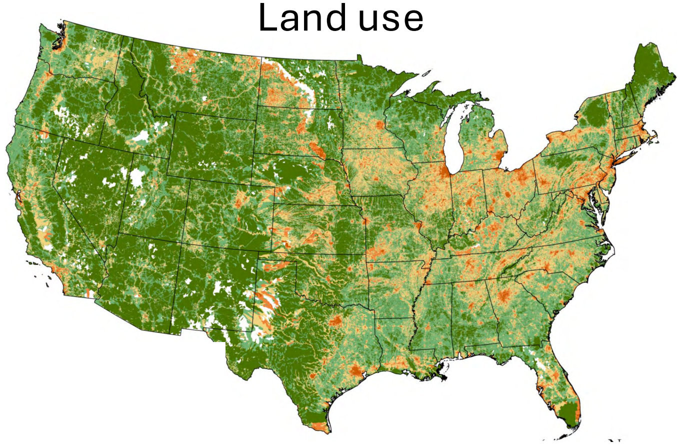
Applications of 2025 NFHP Assessment Results

There are many ways to use the 2025 NFHP Assessment results

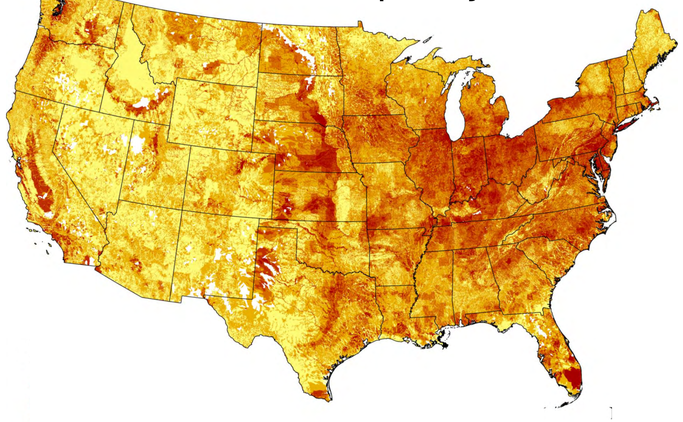
- Use threshold values of individual disturbances

- Combine sub-index scores

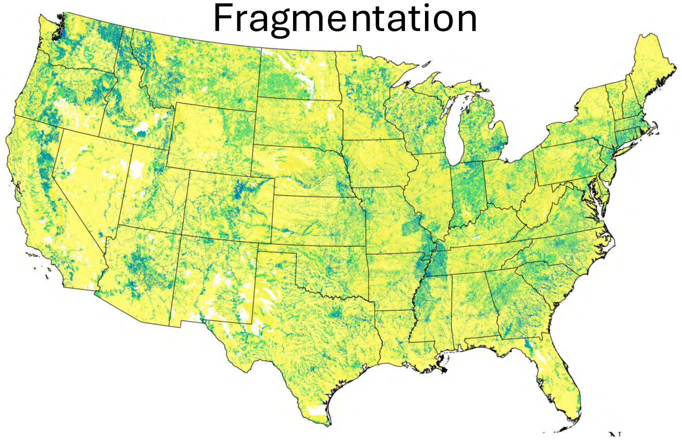
Land use



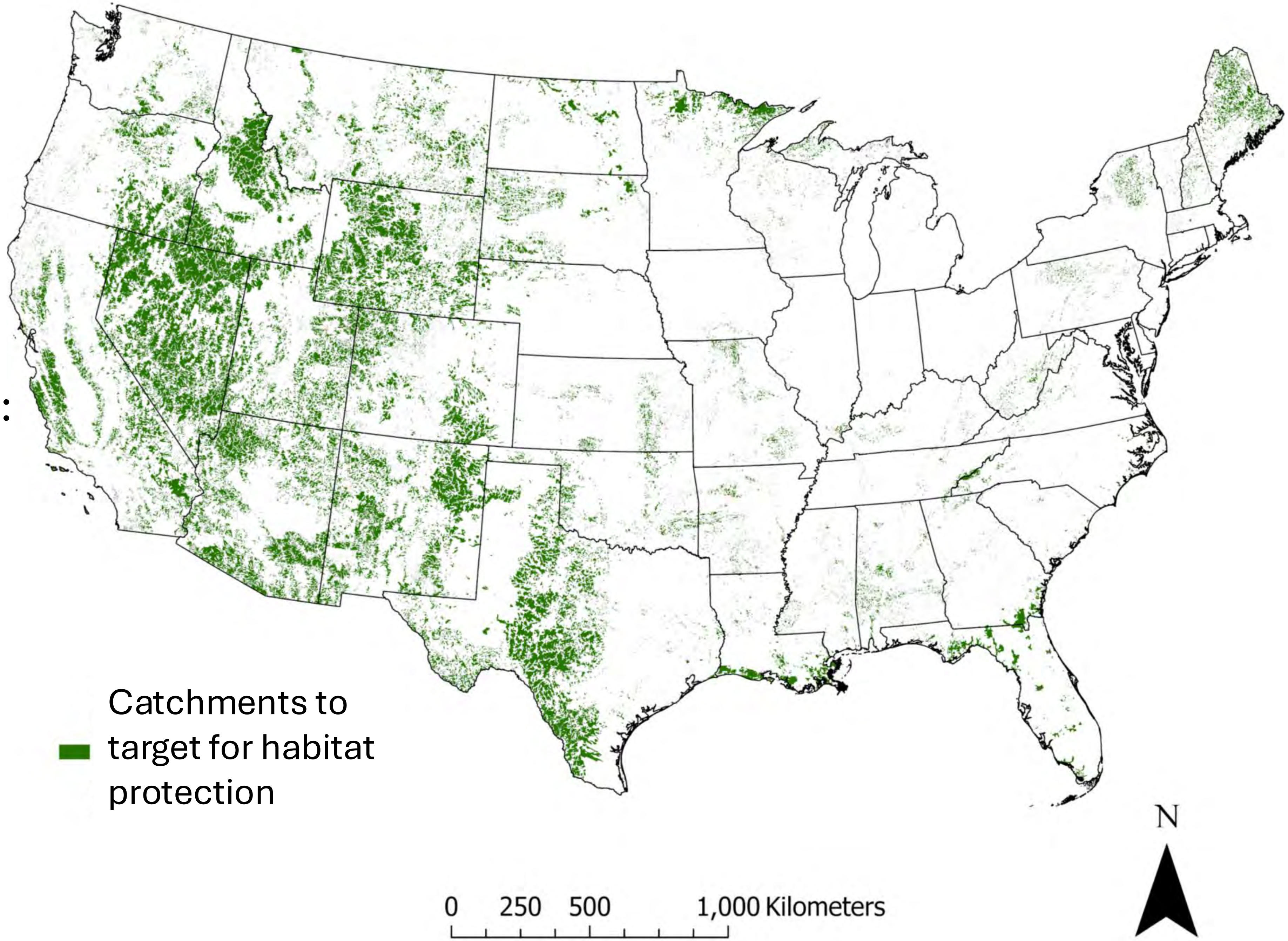
Water quality



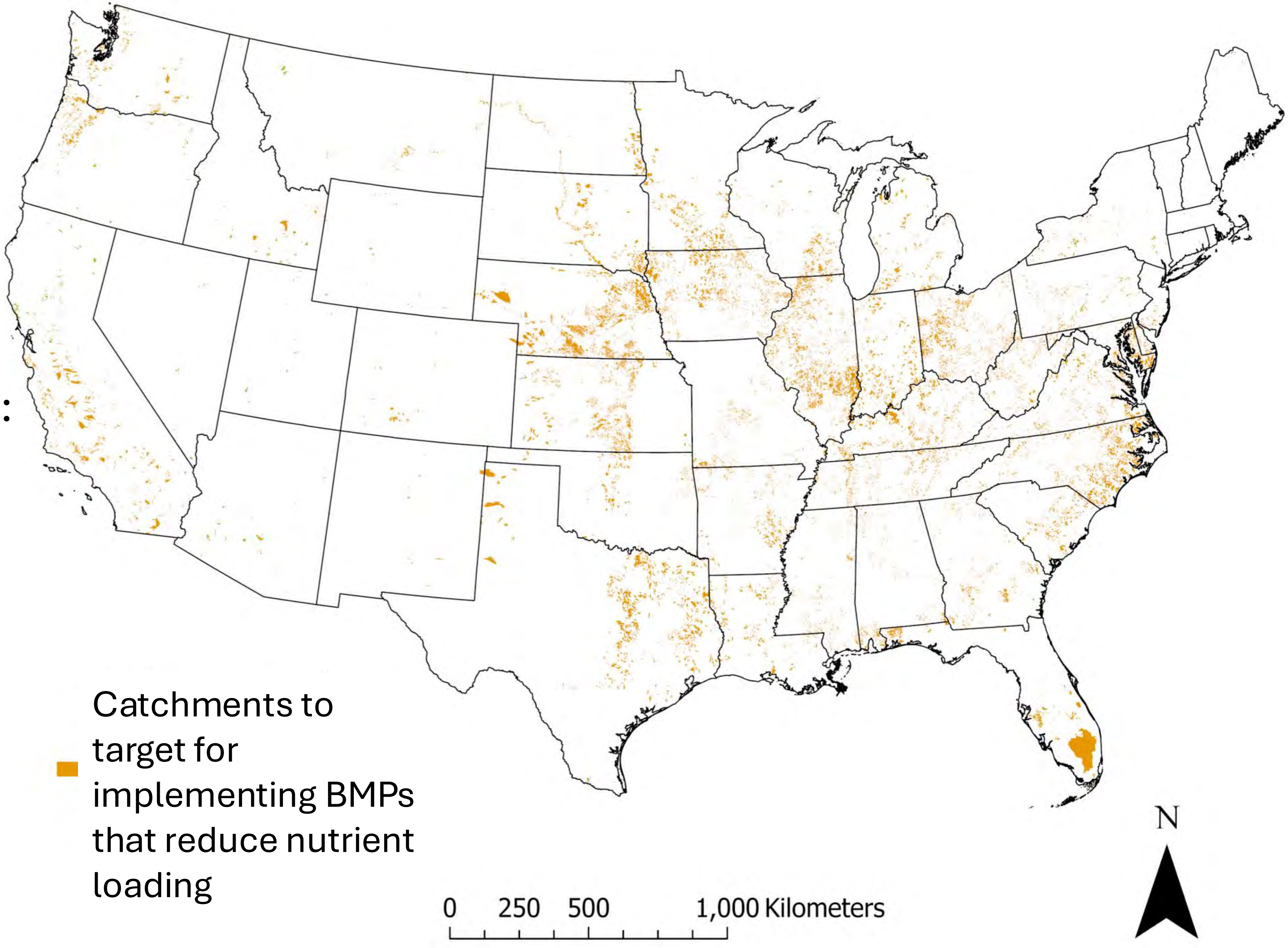
Fragmentation



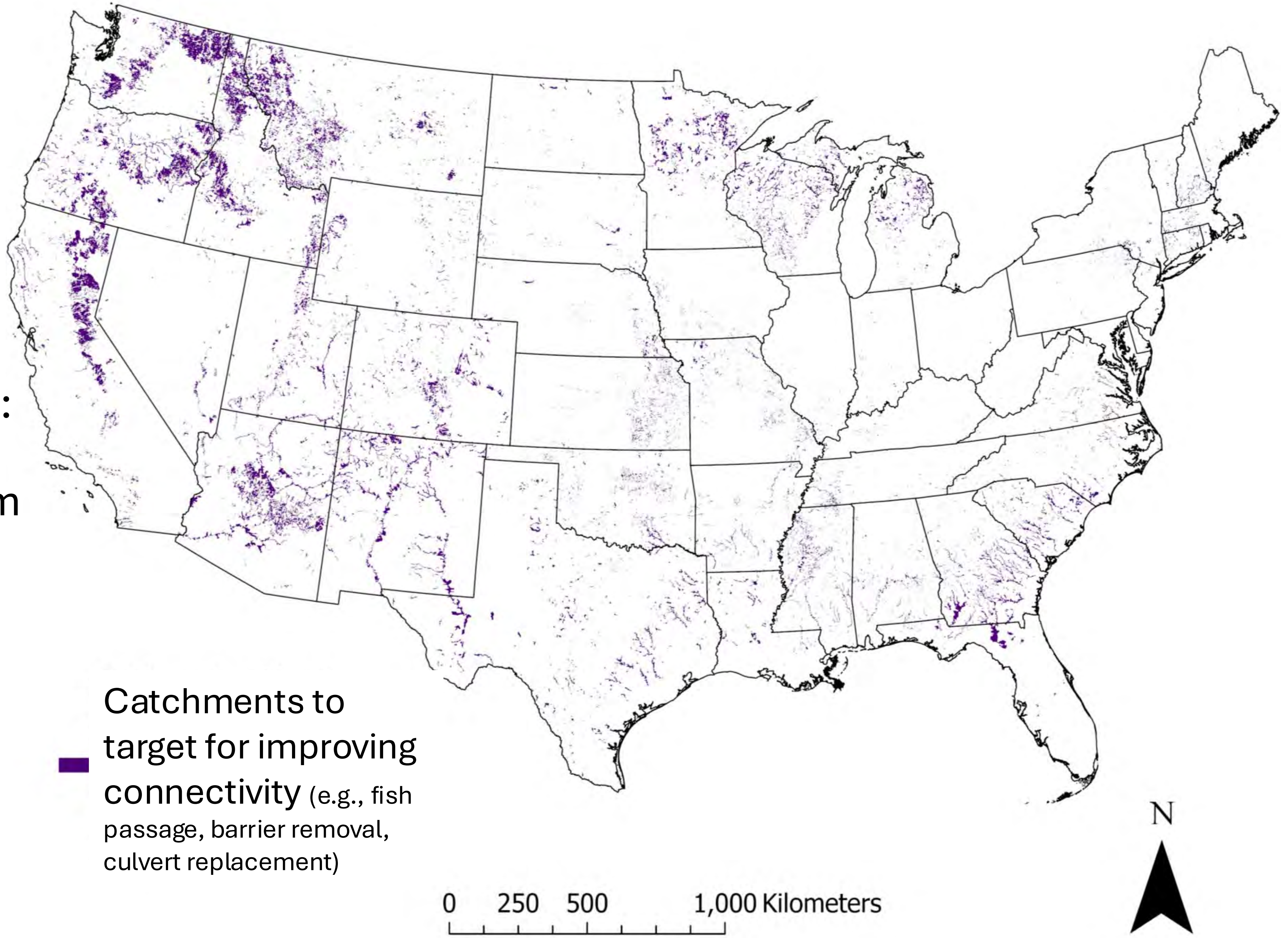
Application of sub-indices: low risk from land use, water quality, and fragmentation



Application of sub-indices: low risk from land use and fragmentation, high risk from water quality



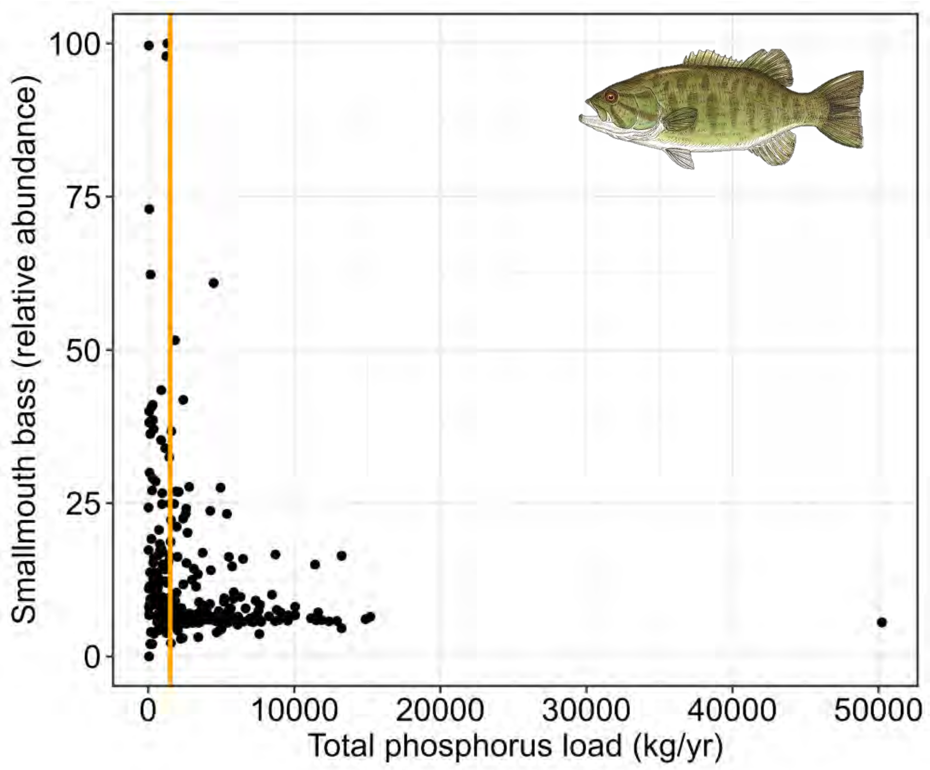
Application of sub-indices: low risk from land use and water quality, high risk from fragmentation



Applications of 2025 NFHP Assessment Results

There are many ways to use the 2025 NFHP Assessment results

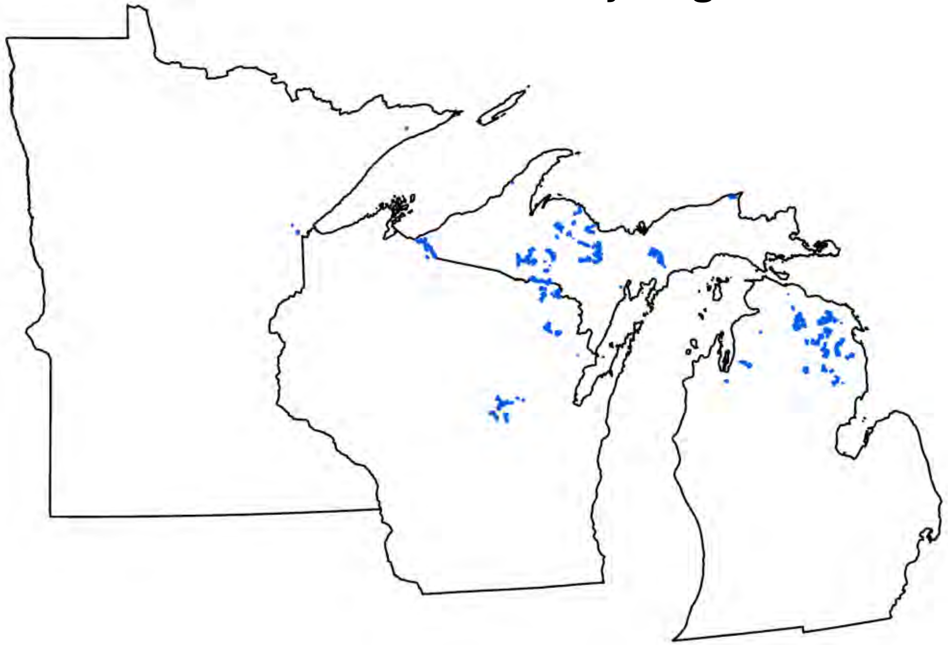
- Use threshold values of individual disturbances
- Combine sub-index scores
- Use species-specific thresholds



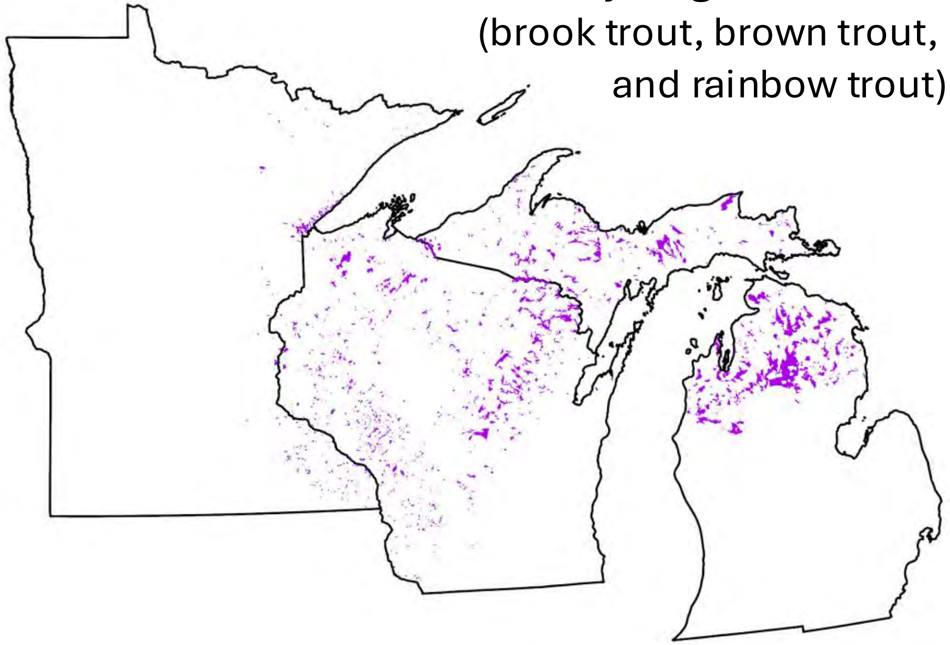
Use species-specific thresholds to manage for species

…or groups of species

Where are **brook trout** limited by fragmentation?



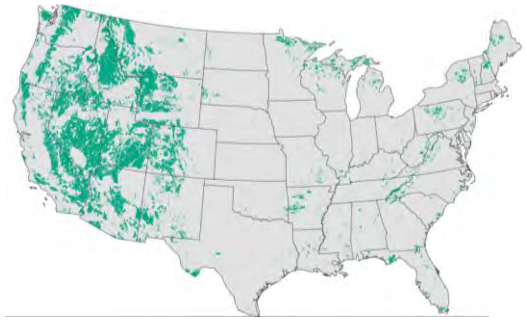
Where are **coldwater fishes** limited by fragmentation?
(brook trout, brown trout, and rainbow trout)



Applications of 2025 NFHP Assessment Results

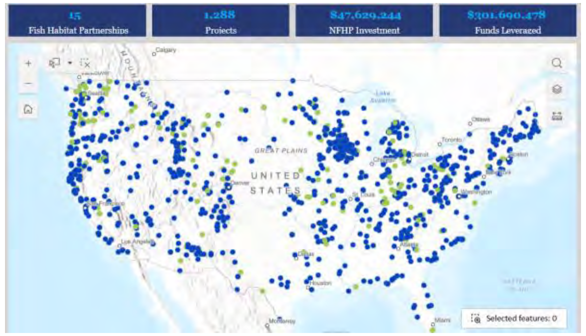
There are many ways to use the 2025 NFHP Assessment results

- Use threshold values of individual disturbances
- Combine sub-index scores
- Use species-specific thresholds
- Combine assessment results with other datasets

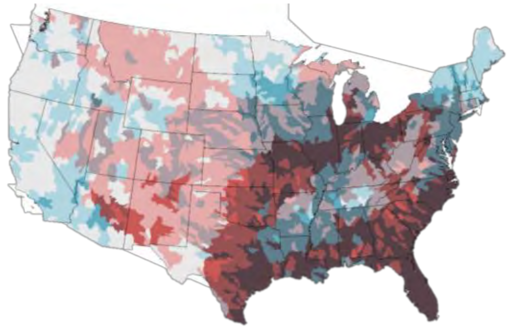


Protected Areas

TNC Freshwater Resilient Connected Networks

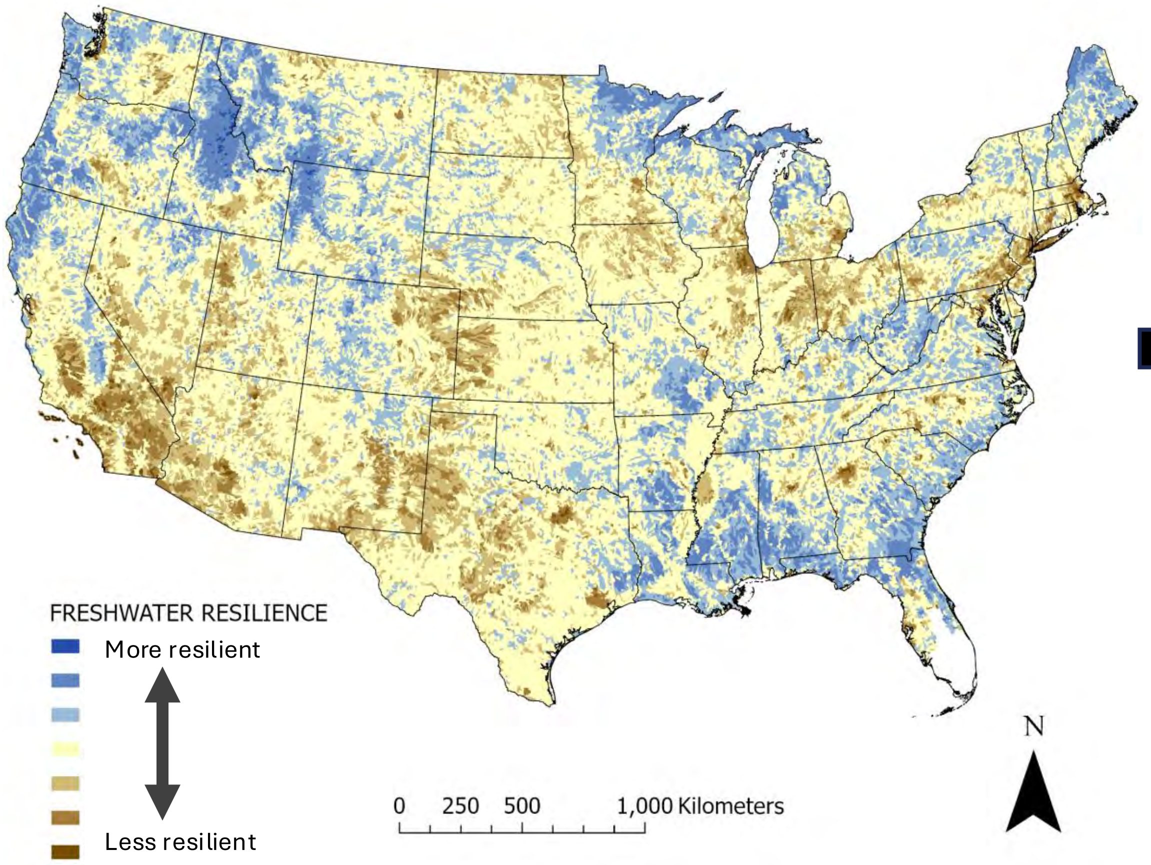


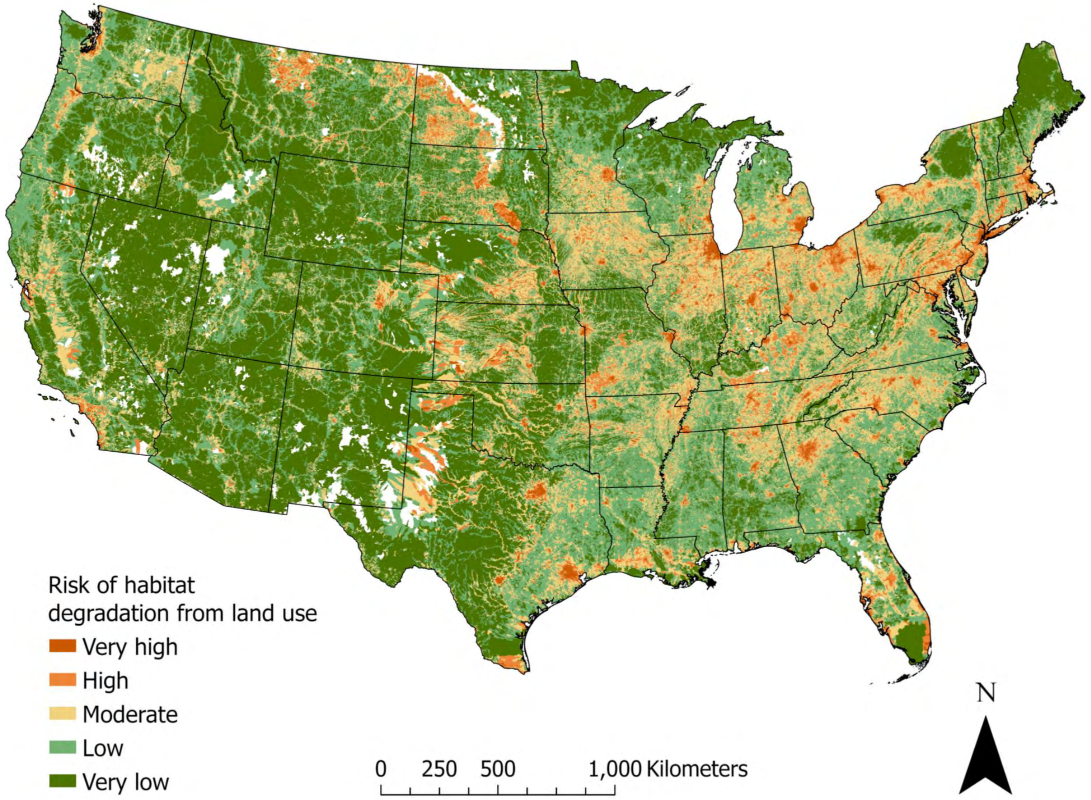
Fish Habitat Partnership Project Sites



Invasive Species Hotspots

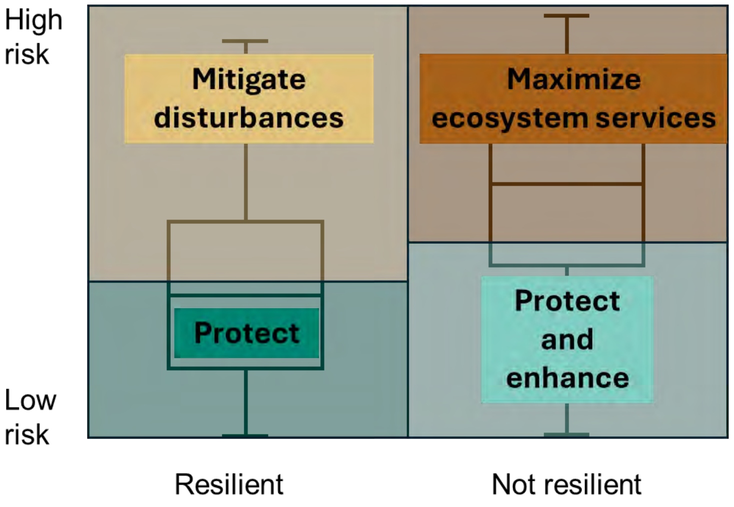
Application of sub-indices with additional information: TNC Freshwater Resilience

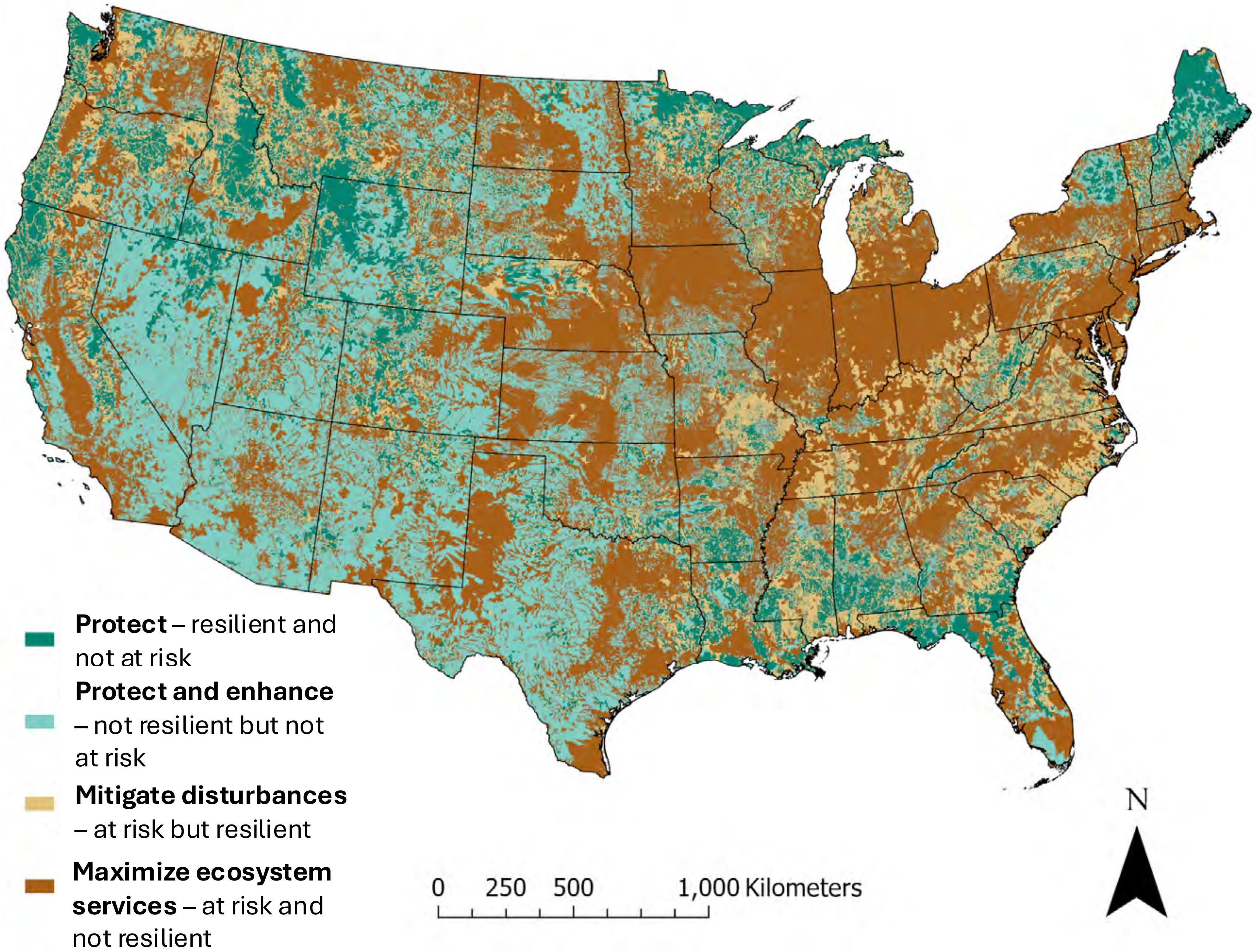




The Nature Conservancy

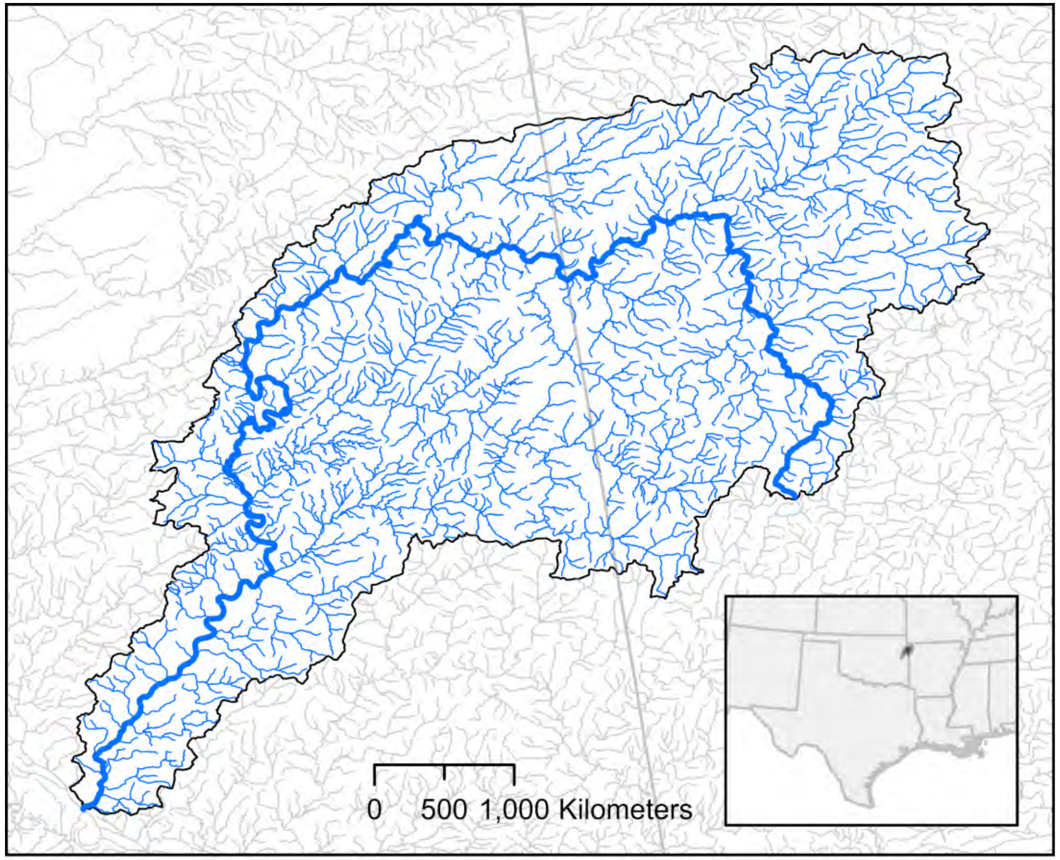
Application of sub-indices with additional information: TNC Freshwater Resilience

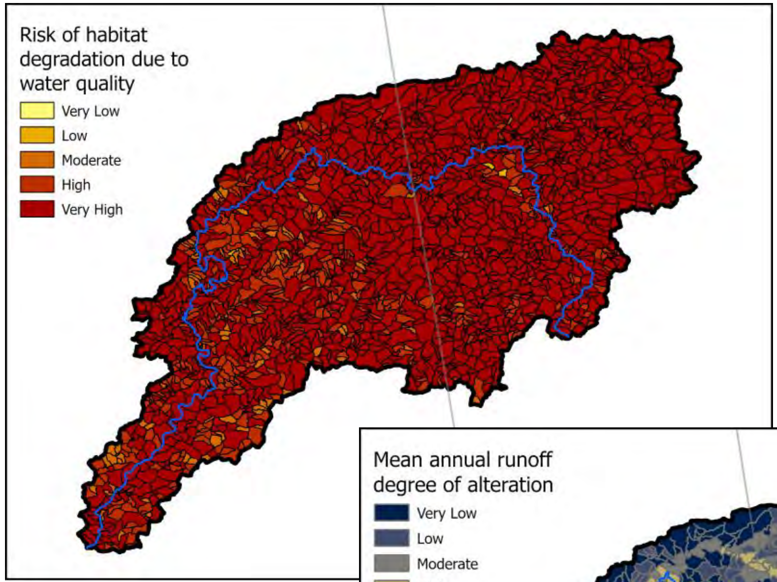


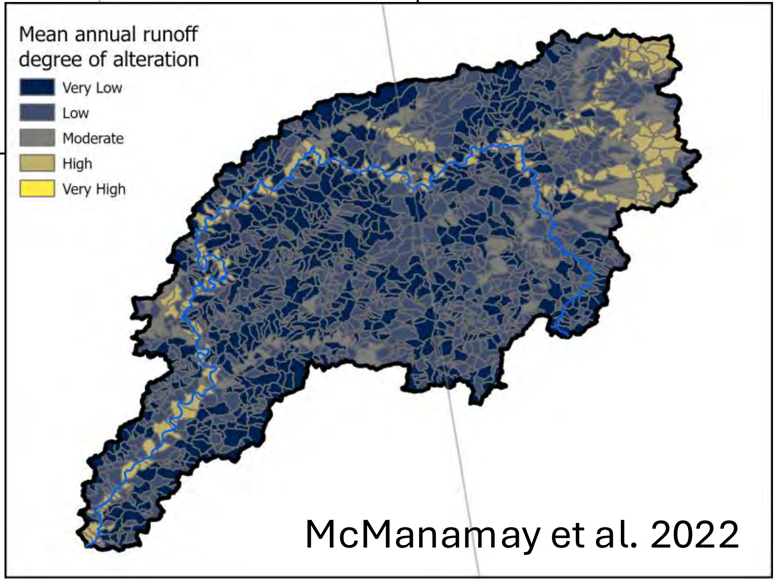


Application of sub-indices with additional information:

Water quality and quantity in the Illinois River Basin (AR-OK)



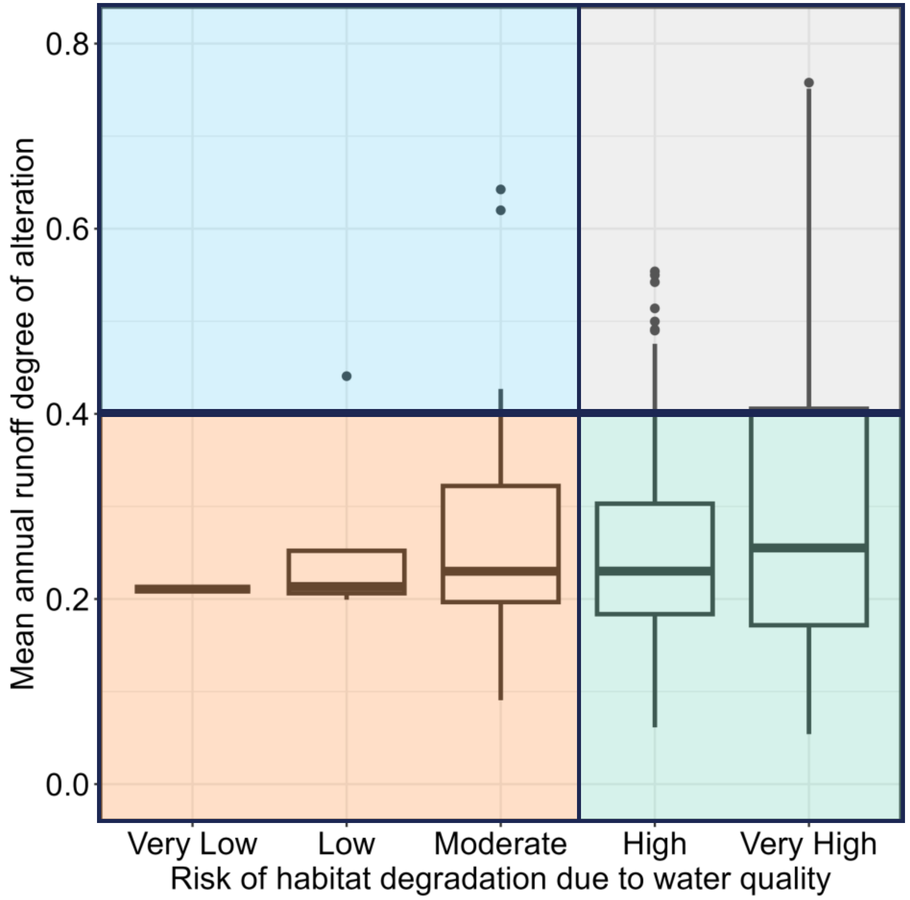


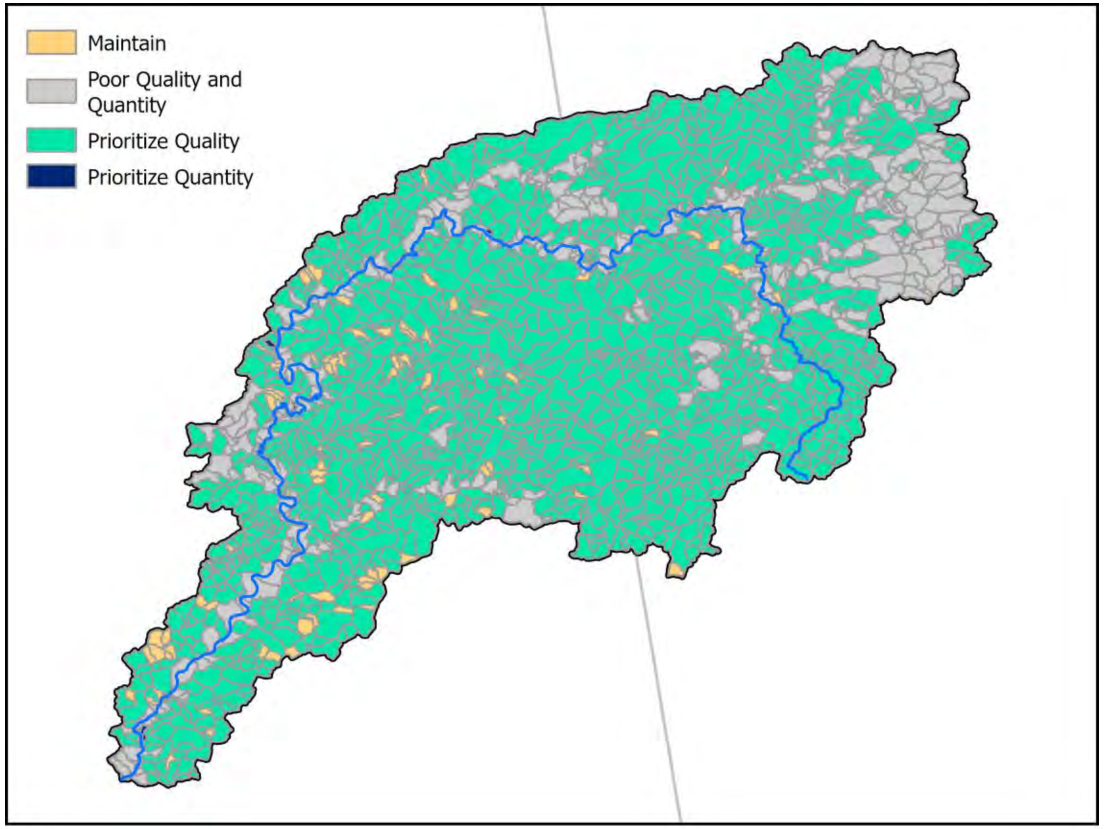


McManamay et al. 2022

Where could water quality restoration be prioritized?

Where could water quality restoration be prioritized?





Future Directions

CONUS Assessment

Testing additional ways to stratify stream reaches

Stream temperature
(StreamCat; Hill et al. 2015)

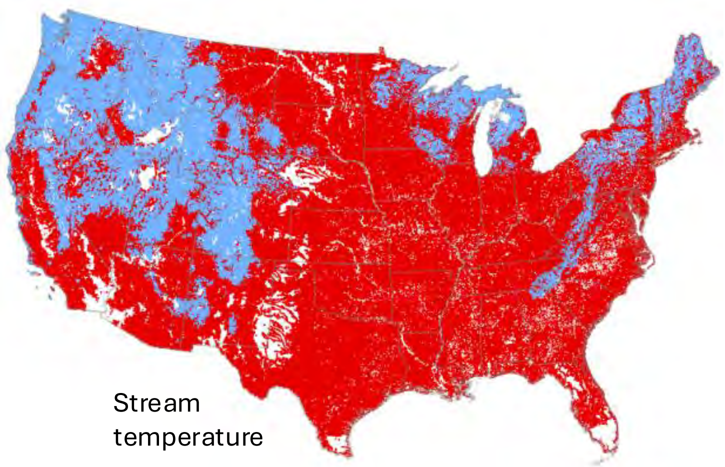
Testing additional disturbance variables

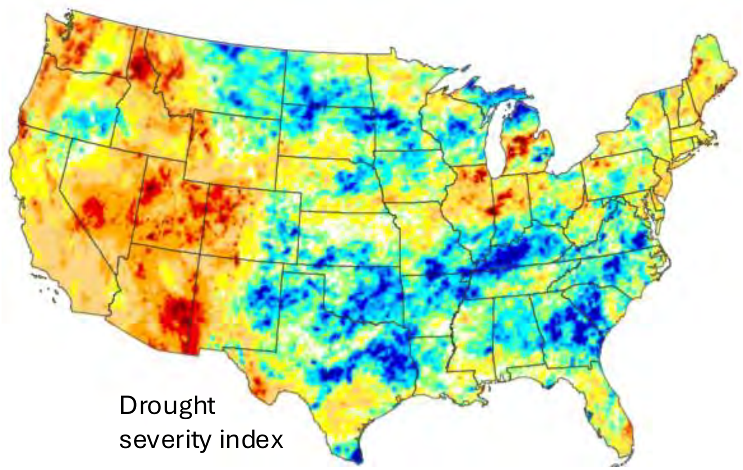
Hydrologic alteration
Water withdrawals
Drought severity
Mine density
Point source pollution

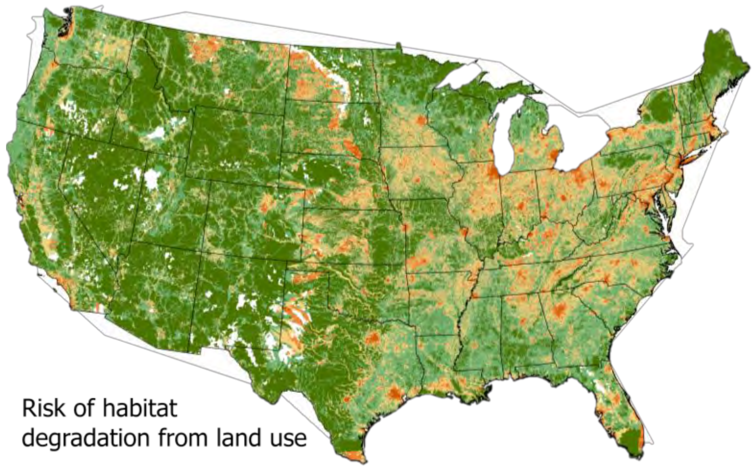
Boat launch density
Wildfire burn area
Timber harvest
Grazing
Tile drainage

Creating additional sub-indices

Agriculture
Urbanization







Alaska, Hawaii, and Puerto Rico Assessments

Identifying best available spatial frameworks

Compiling available datasets

Integrating datasets into spatial framework

Acquired fish assemblage data for Puerto Rico

2025			2026
October	November	December	January

Finalize and map core sub-indices
(land use, fragmentation, and water quality)

Explore additional sub-indices

Finalize and map additional sub-indices

Finalize and map cumulative disturbance scores

Complete final report describing preliminary CONUS assessment

Complete inventory and assessment plans for Alaska, Hawaii, and Puerto Rico

Continue developing applications with CONUS results

Begin assessment of Alaska, Hawaii, and Puerto Rico

National Fish Habitat Partnership

Stream Habitat Assessment 2025 Preliminary Results

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Department of Fisheries and Wildlife
Michigan State University
September 18th, 2025

Supplemental Slides

Natural landscape factors determine stream potential

Includes factors like

climate

geology

topography

natural land cover

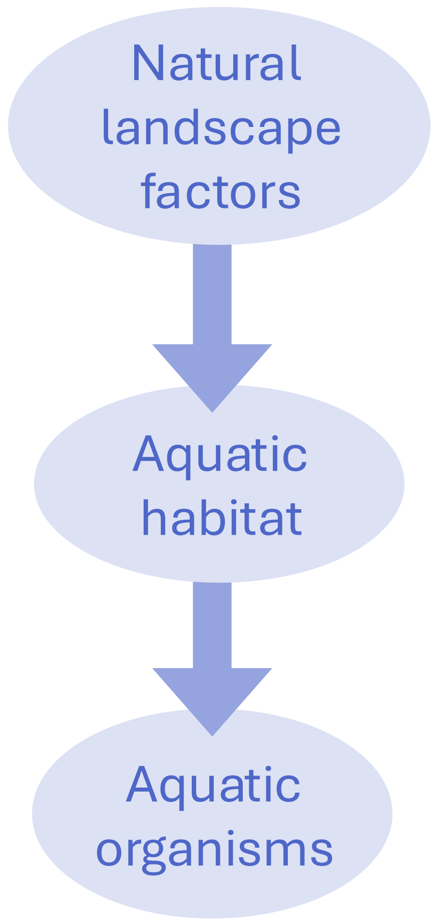
that determine

physical structure

hydrologic and thermal regime

sediment loading

nutrient dynamics



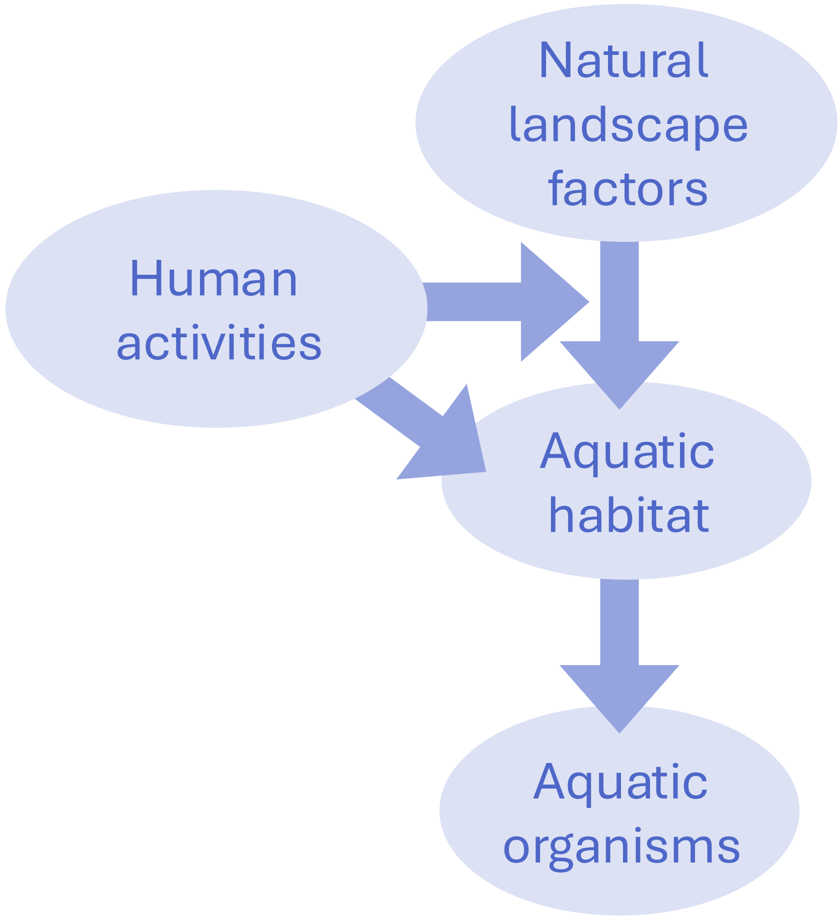
Anthropogenic activities on the landscape can degrade stream habitats

Includes activities like

urban and agricultural land use
nutrient pollution
roads
dams and other barriers

that can lead to

altered hydrologic and thermal regimes
excess nutrients
reduced habitat connectivity



2015 and 2025 Assessments are Not Directly Comparable

More species included

More disturbance variables included

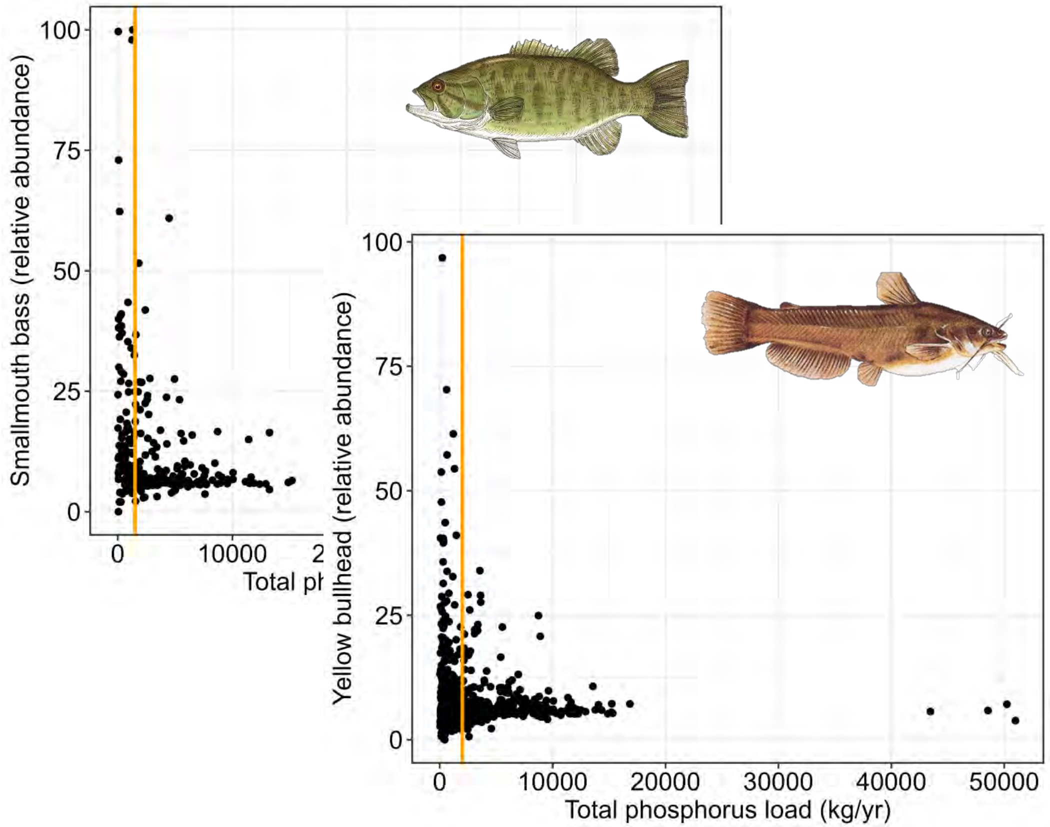
Species focused assessment rather than metric focused

Improved stream condition scoring protocol

I. Create scores for each limiting disturbance

Determined scores (1- 5, worst - best) for every limiting disturbance in every ecoregion and size stratum

The highest and lowest species-specific thresholds determined the two best condition classes

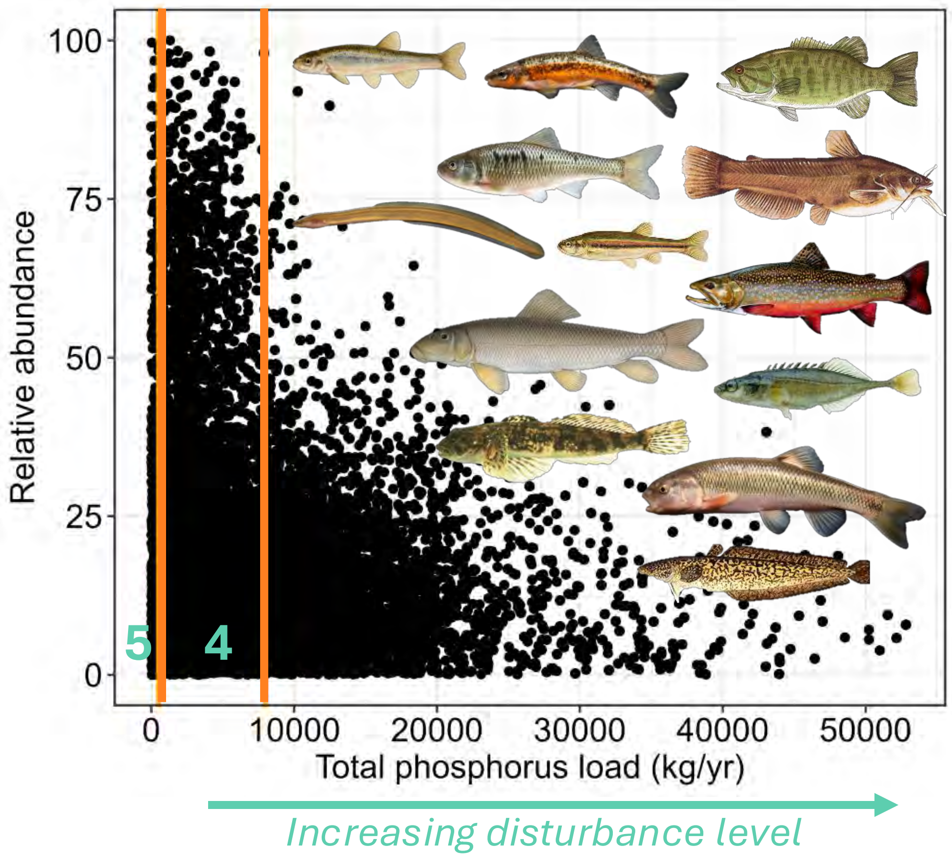


Assemble data | Integrate into spatial framework | Control for natural variation | Identify limiting disturbances | Create and apply scores

I. Create scores for each limiting disturbance

Determined scores (1- 5, worst - best) for every limiting disturbance in every ecoregion and size stratum

The highest and lowest species-specific thresholds determined the two best condition classes



I. Create scores for each limiting disturbance

Determined scores (1- 5, worst - best) for every limiting disturbance in every ecoregion and size stratum

The highest and lowest species-specific thresholds determined the two best condition classes

The greatest disturbance level where a fish was collected was identified

The range between that level and the highest threshold was divided into three equally to determine remaining classes