

Presented at

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EMAP
Great River Ecosystems



U.S. EPA Office of Research and Development


Environmental Monitoring and Assessment Program

The Minnesota Pollution Control Agency's Approach to Site Selection and Reference Condition for the Development of Biological Criteria

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Outline

- Very brief intro. to MPCA program
 - Geographic framework
 - Candidate site selection
 - Reference determination
 - Current status of program
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Components of the MPCA's Stream Biological Monitoring Program

➤ Fish and macroinvertebrate
community assessment



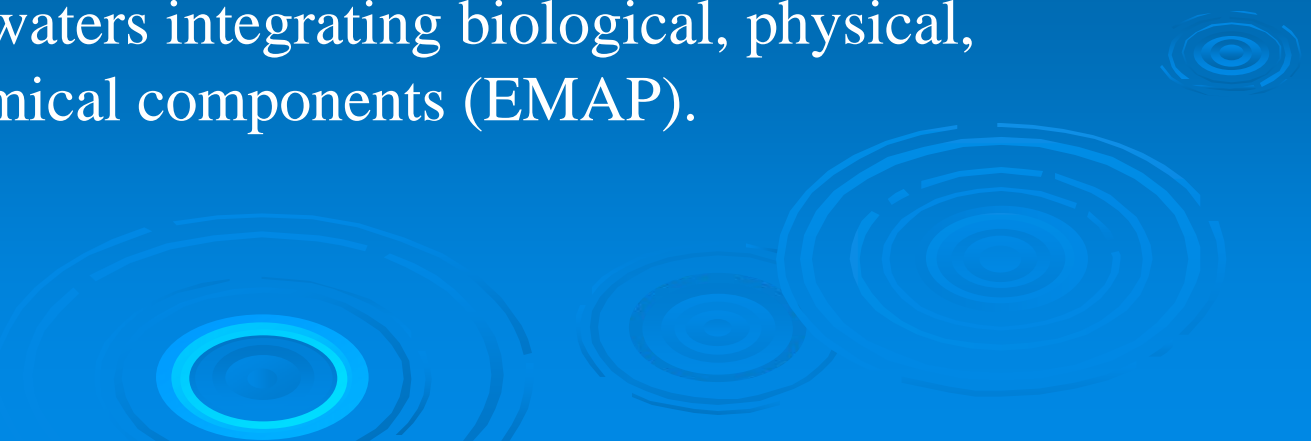
➤ Habitat assessment



➤ Water chemistry



Primary Objectives

- 1.) To develop regional indices of biological integrity (IBI's) using attributes of fish and macroinvertebrate communities. Eventual adoption of numeric biological criteria into state water quality standards.
 - 2.) To assess the status and trends of riverine surface waters integrating biological, physical, and chemical components (EMAP).
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- The bottom right corner of the slide features a decorative graphic of several concentric, light blue circles of varying sizes, resembling ripples on water, set against the dark blue background.

Site Selection

IBI Development:

Targeted sites within stream classes across a range of human disturbance, from minimal to severe.

Probabilistic Monitoring:


Specified number of sites randomly generated following EMAP, stratified by stream order.

Minimization of variability from natural factors

Regionalization and Classification

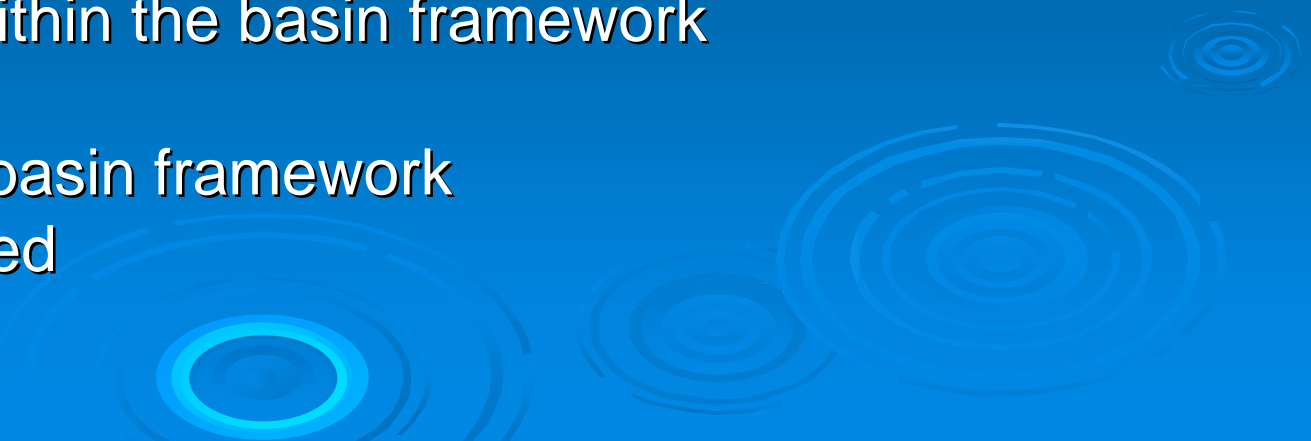
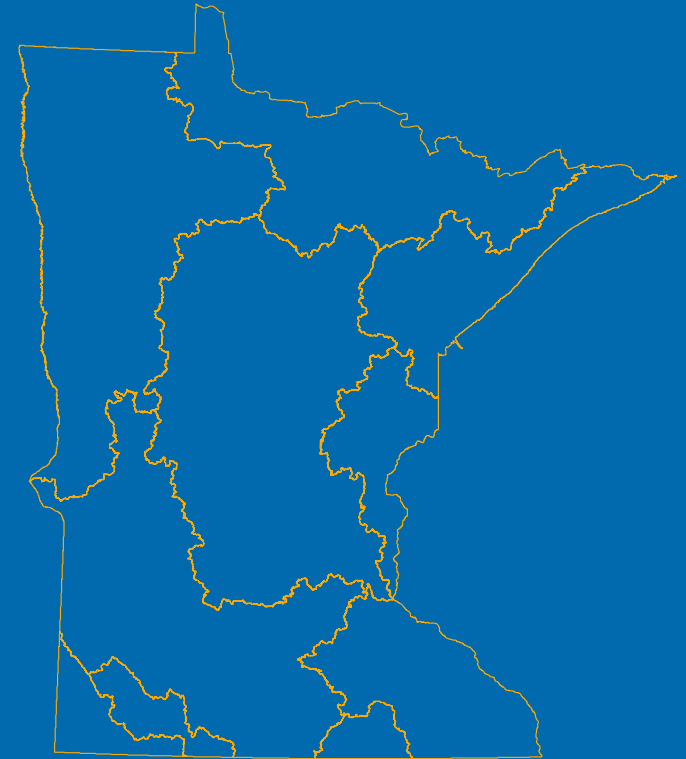


Regional Frameworks

- Ecoregions - level 3, level 4?
 - Major River Basins - 10 in Minnesota
 - DNR Ecological Classification System - province, section, subsection?
 - Other regional approaches?
- 

The MPCA has used a basin framework for IBI development

- Reasons were initially political
- Development of interim criteria in absence of statewide dataset
- Some testing of eco-regional differences in communities within the basin framework
- Recognition that basin framework will be re-evaluated



Stream Classification

- Stream size – headwaters to large rivers
- Water temperature – warm and coldwater streams
- Stream morphological differences – riffle/run streams and glide/pool streams



Identification of candidate reference (and stressor) sites

- Stressor gradient approach
- Least impacted approach to reference
- GIS based method
 - Watershed and reach level scales
 - Numerous stressor coverages
 - Rating system for each stressor
 - Subjective weighting utilized in rating

Poor Quality



High Quality

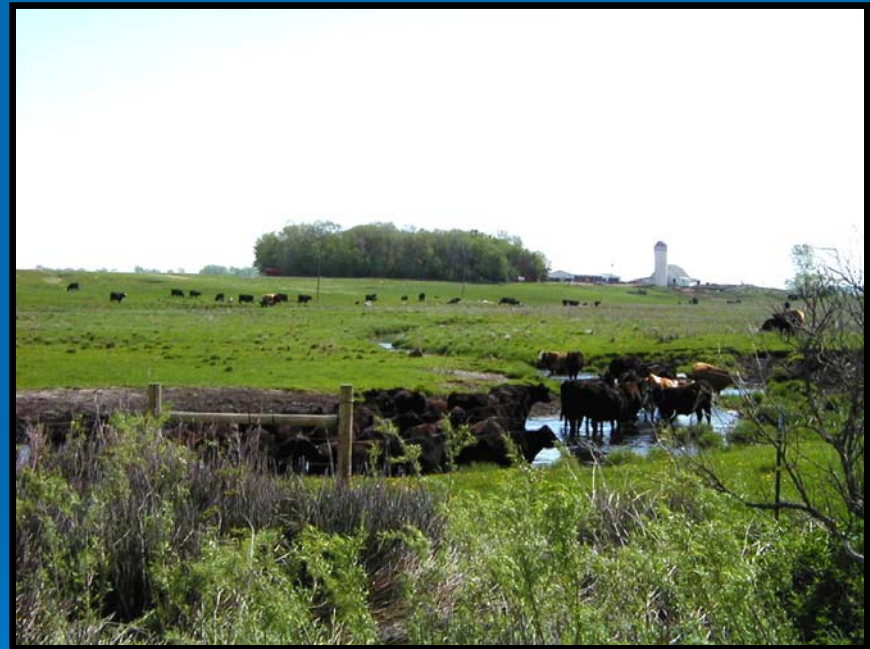
Available GIS Coverages

- Land use - (National Land Cover Data, USGS, 1992) identifies various forms of agriculture, urbanization, forest types and waterbody types
 - Public land coverage
- Streams – Department of Transportation stream coverage identifies channelized streams/ditches
 - Class 7 coverage - Designation by MPCA
 - Coldwater stream coverage - designation by MDNR
 - Drainage area delineation by minor watershed



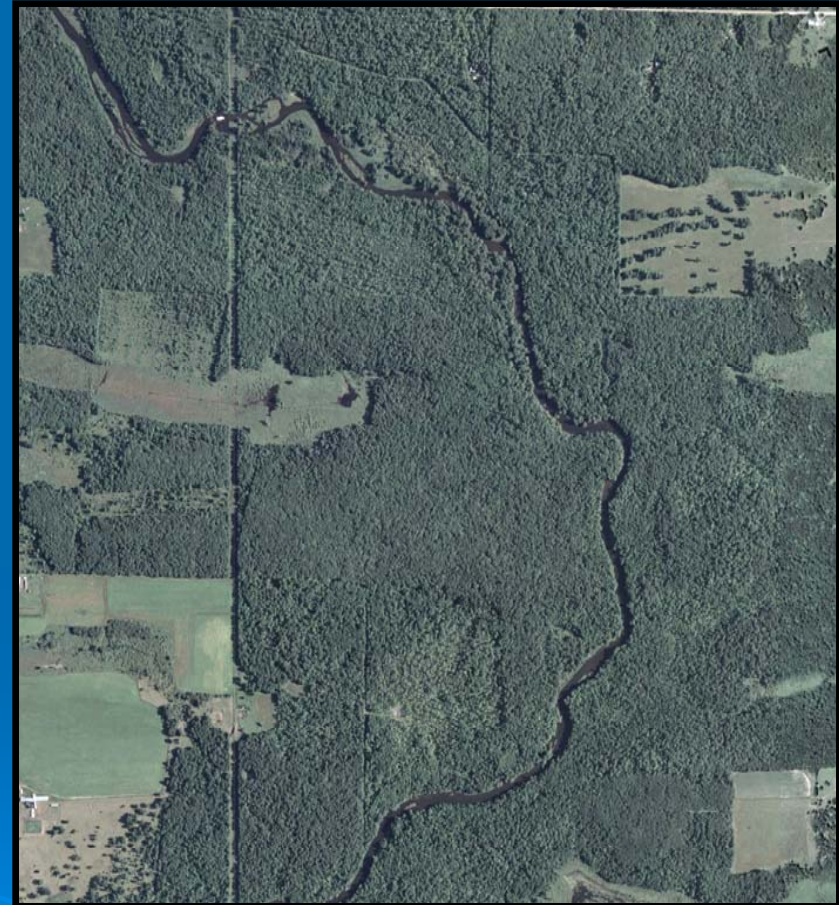
Available GIS Coverages (continued)

- Permitted feedlots and active dairy operations – size (AU)
- Industrial and municipal point source discharges
 - Surface water discharge and land application discharges identified
 - Problem point sources identified – violations of a water quality standard in recent reporting history
- Dams
- Landfills
- Road density

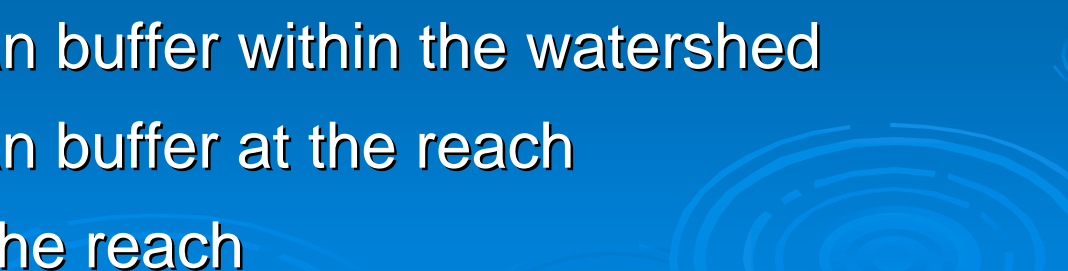


Reach level tools

- Quality of the riparian zone and evidence of channelization
 - NLCD coverage
 - DOQ's



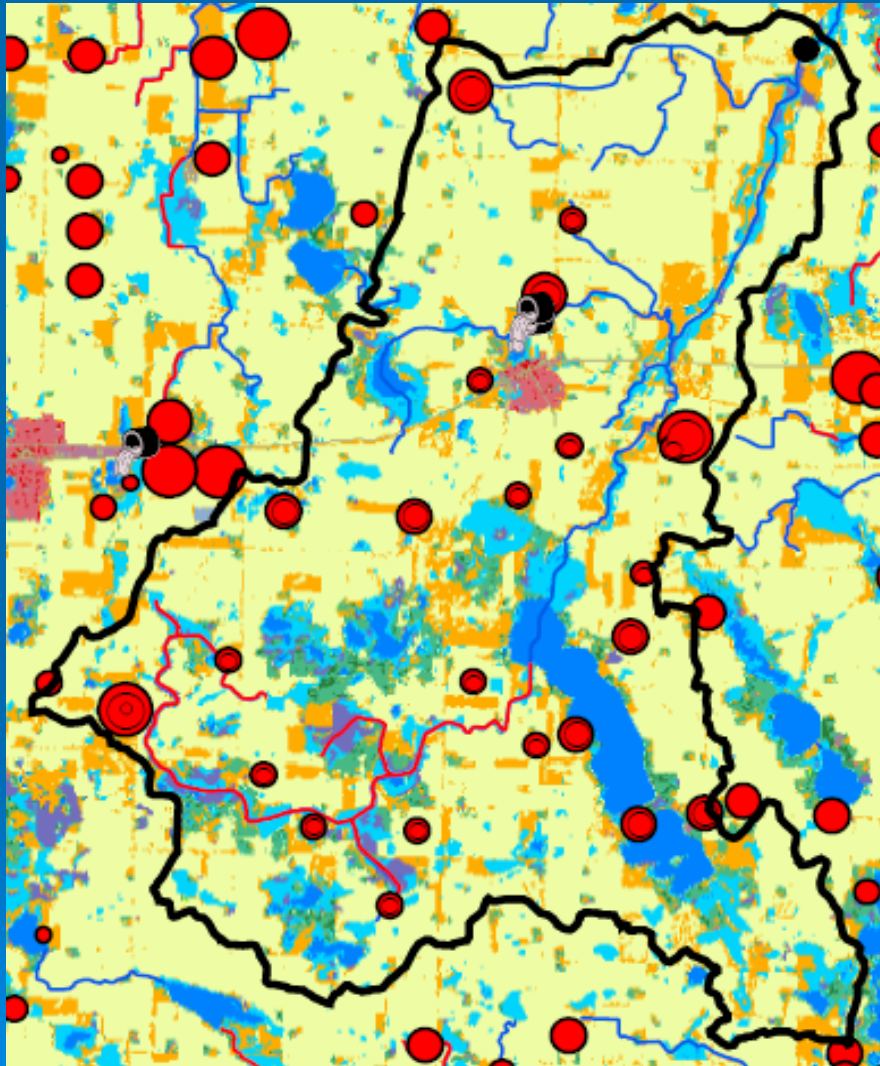
Watershed Disturbance Factors

- Percent agricultural land use in the watershed
 - Percent “developed” land use in the watershed
 - Number, size, and proximity of permitted industrial and municipal facilities within the watershed
 - Number, size, and proximity of permitted feedlots within the watershed
 - Extent of ditching or channelization within the watershed
 - Condition of riparian buffer within the watershed
 - Condition of riparian buffer at the reach
 - Channelization at the reach
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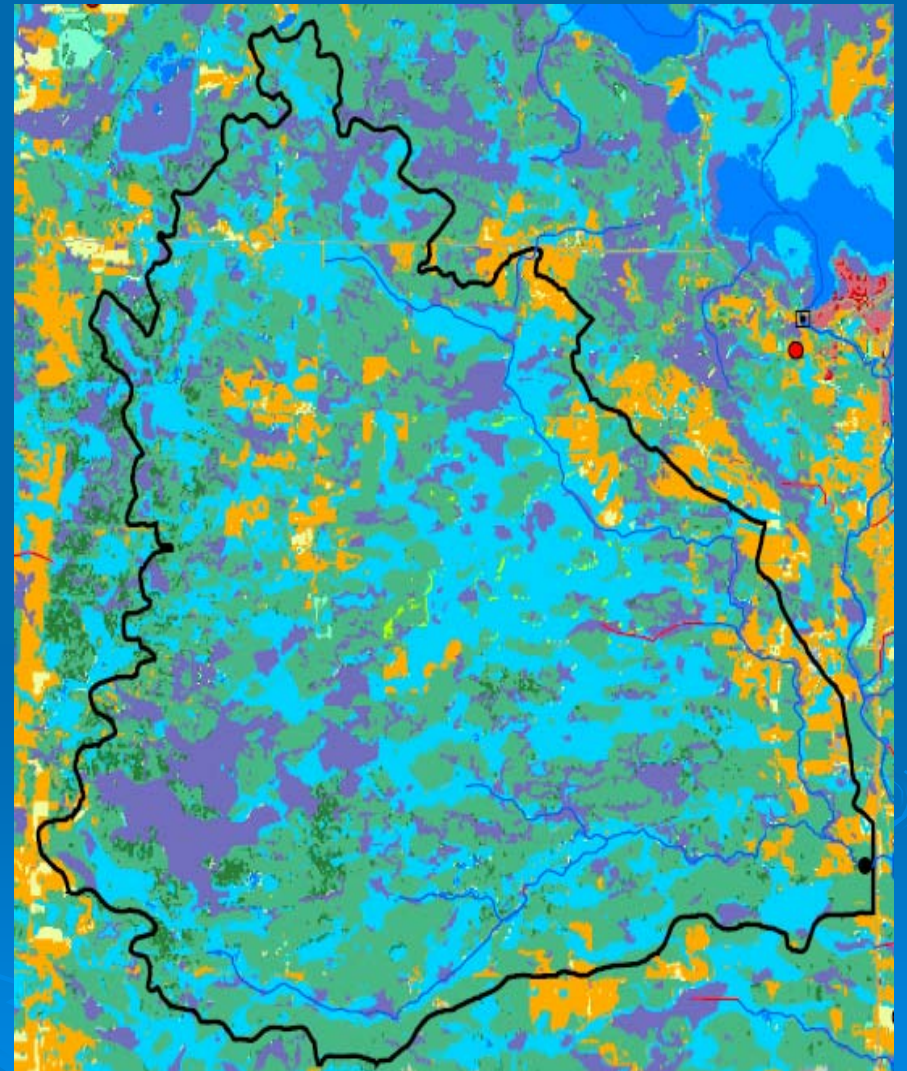
Qualitative Scoring Criteria

- Rating based on size (extent) and proximity of stressor relative to other sites in the basin of comparable size and type
- Scoring
 - 5 – best possible situation
 - 4 – nearly the best situation
 - 3 – above average
 - 2 – below average
 - 1 – close to the worst situation
 - 0 - comparable with the worst

The Upper Mississippi River Basin Disturbance Gradient



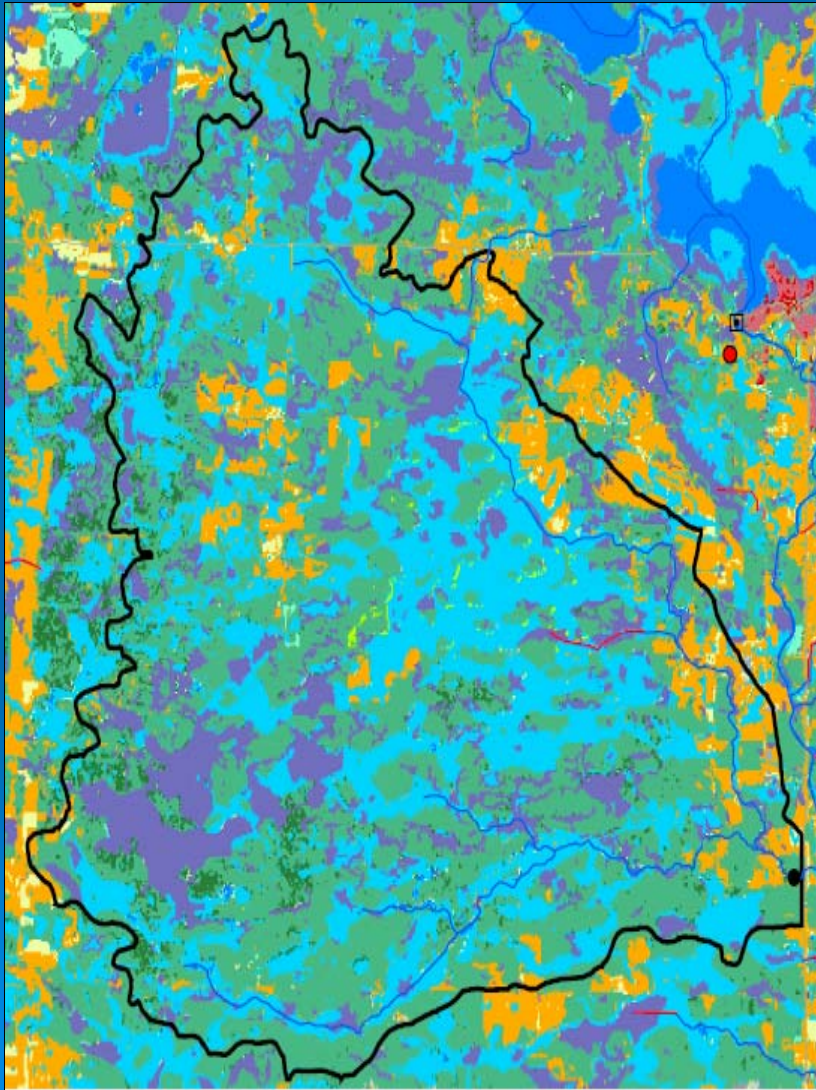
Grove Creek, UM Basin, NCHF Ecoregion



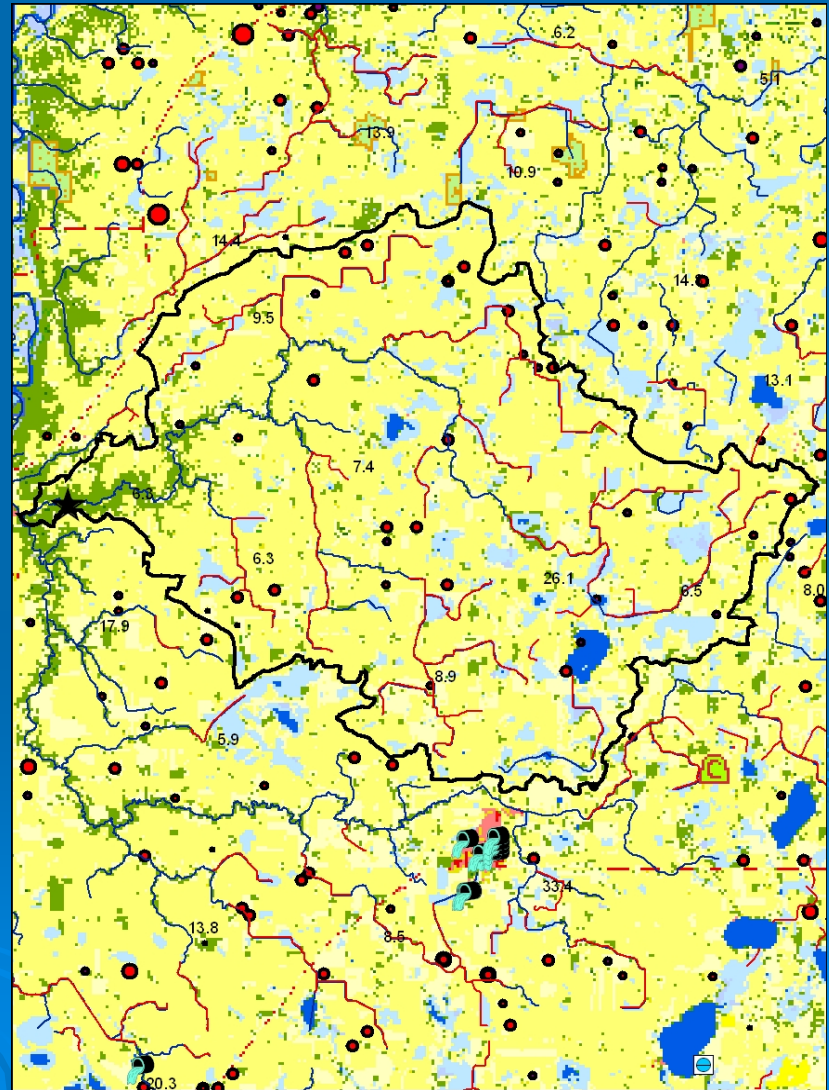
Bradbury Brook, UM Basin, NCHF Ecoregion

Regional Differences in Least Impacted

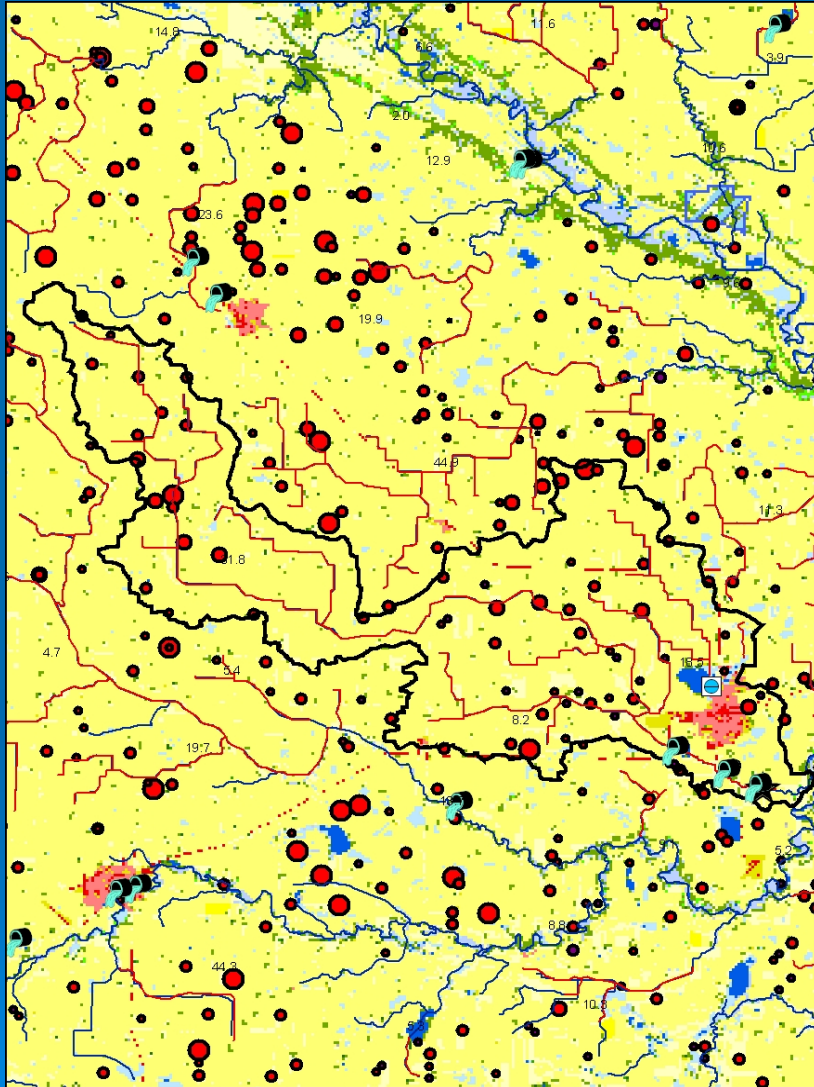
Bradbury Brook, Upper Miss. Basin



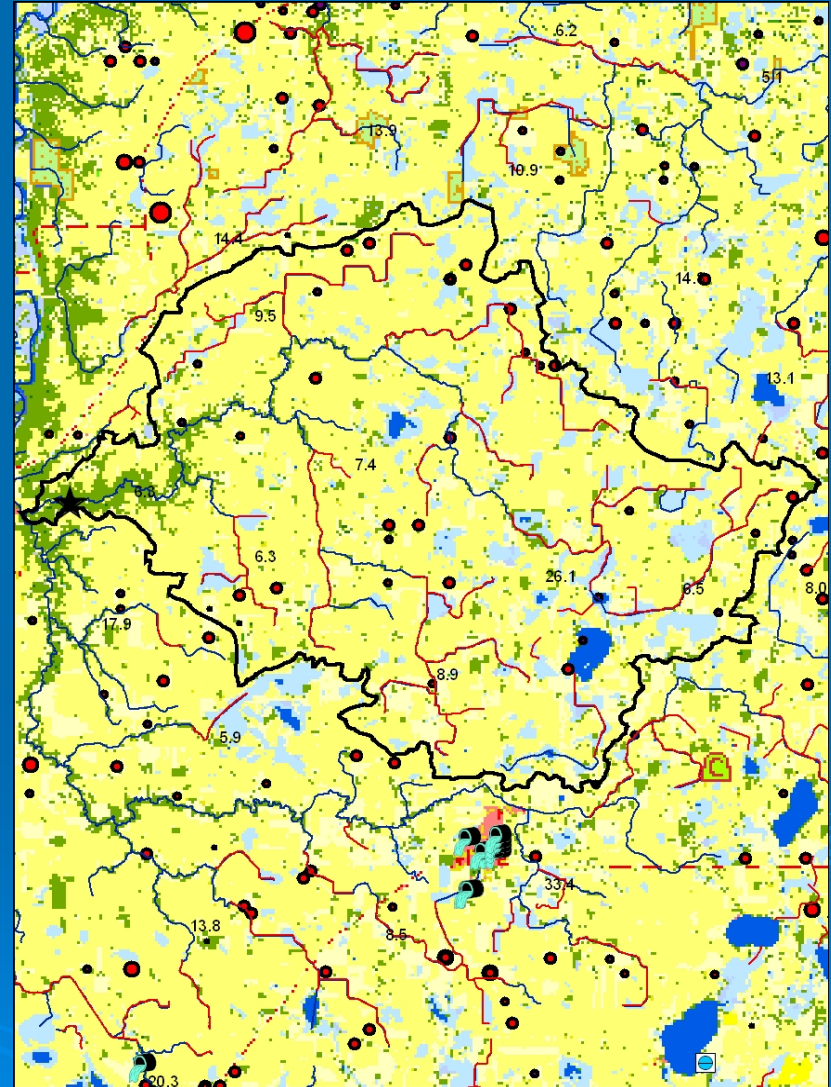
Forest Prairie Creek, Minnesota Basin



The MN River Basin Disturbance Gradient



JD #30



Forest Prairie Creek

Overview

- Identify candidate sites across a range of disturbance to sample. Emphasize best and worst condition (random sites supplement the middle).
- Effort is made to capture the range for each potential stream class within the basin (ecoregion also considered).
- Candidate sites are ground truthed during site recon.
- Sample: fish, invertebrates, habitat, water chemistry.
- Next step - determine reference condition.

Selection of Reference Sites

- Information from the GIS watershed rating process along with habitat data collected during the site visit is used to select reference sites.
- Biological information is not used to select reference sites.

Reference Conditions

(other considerations independent of ratings)

- Natural stream geomorphology
- No stream habitat alteration (rip rap, etc.)
- No dams within two meander cycles

Upper Mississippi River Basin

Reference sites (5-35 mi² drainage area)

➤ Small streams

- Watershed rating over 27
- Habitat rating of ≥ 6 (0 to 12 range)
- 15 of 40 sites considered reference quality

Kettle Creek (Becker County)



Upper Mississippi River Basin

Reference sites (35-200 mi² drainage area)

➤ Moderate size streams

- Watershed rating over 29
- Habitat rating of ≥ 8 (0 to 12 range)
- 15 of 40 sites considered reference quality

Schoolcraft River (Hubbard County)



Upper Mississippi River Basin

Reference sites (>200 mi² drainage area)

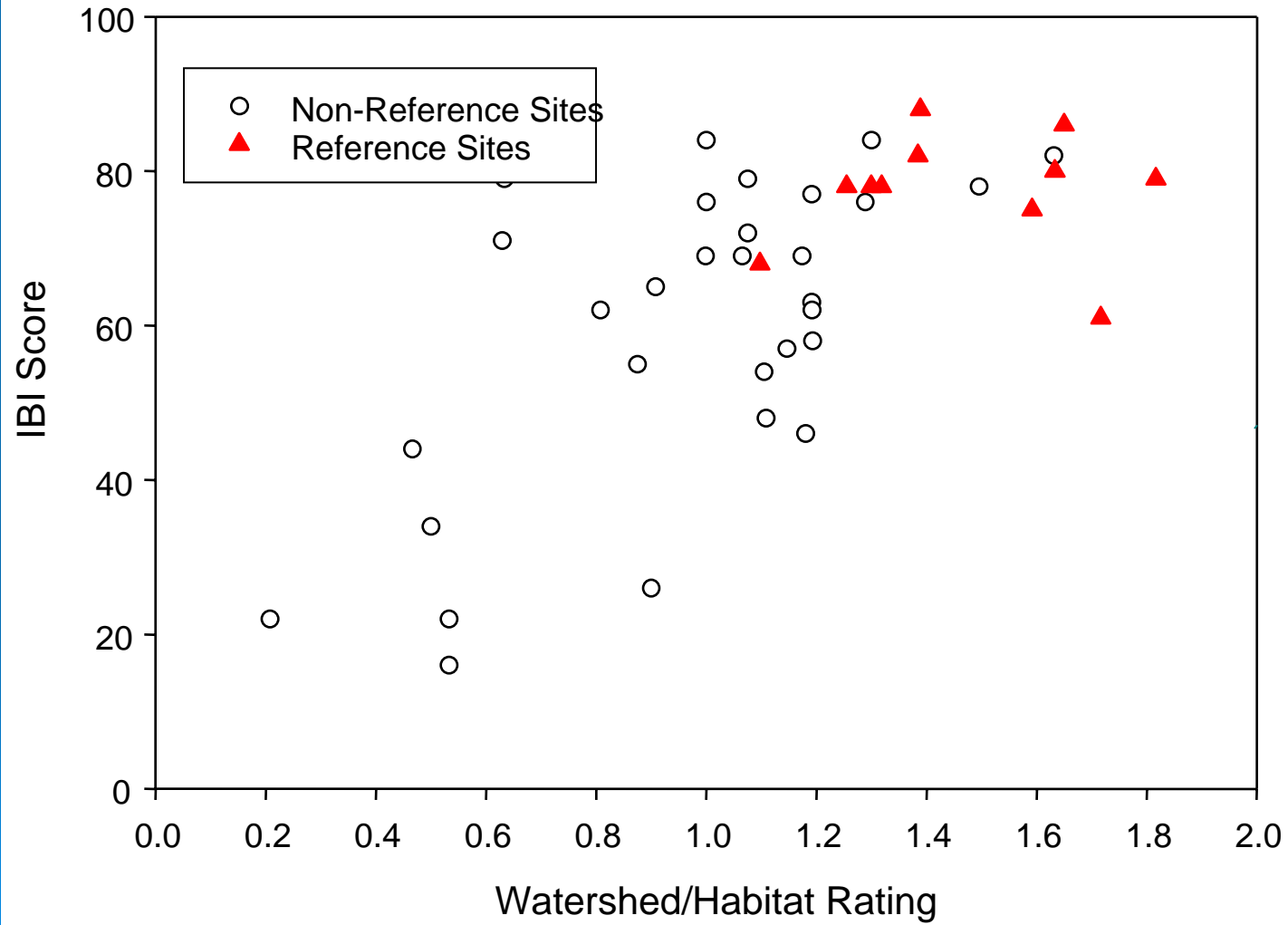
➤ Rivers

- Watershed rating over 25
- Habitat rating generally above 70th percentile
- 11 of 40 sites considered reference quality

Pine River (Crow Wing County)



Upper Mississippi River Basin (Drainage Area >200 mi²)



Where we've been....

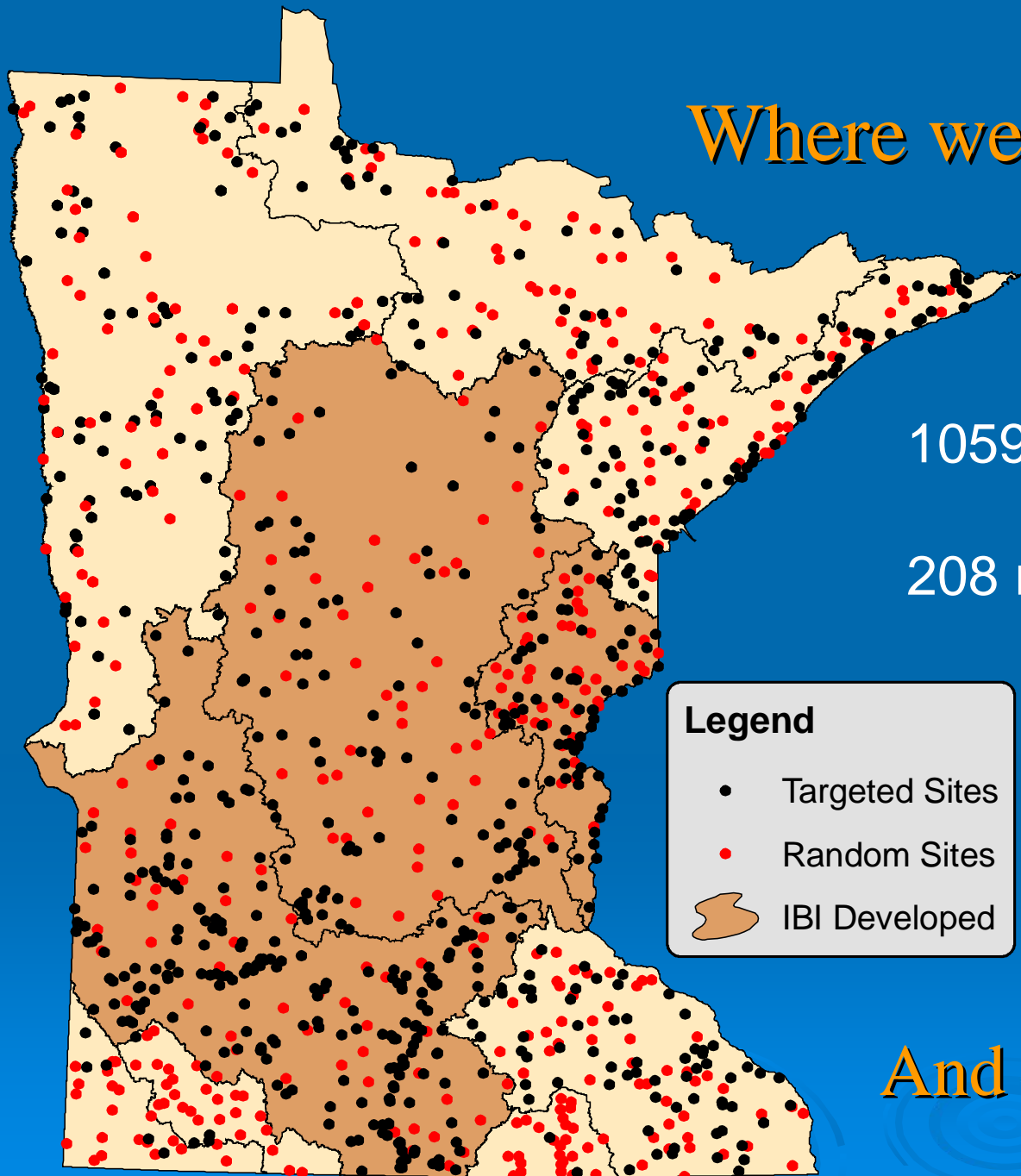
1059 stations

208 replicate samples

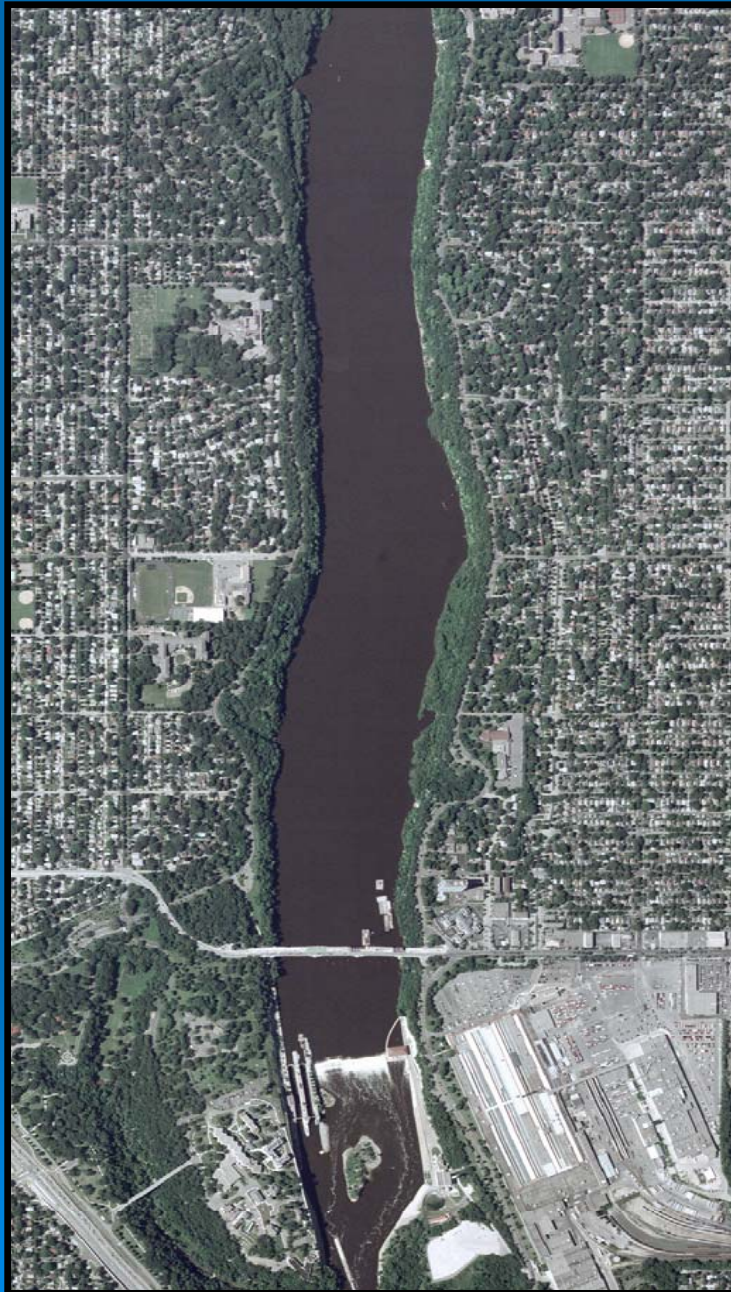
Legend

- Targeted Sites
- Random Sites
- IBI Developed

And what's next...?



- Finally, a statewide dataset (but is it sufficient)?
- Re-evaluate geographic framework
- Fill any data gaps
- Improve measurement of human disturbance?
- Develop biological criteria statewide for streams of all sizes and classes (headwaters to large rivers, coldwater to warmwater, exception...?)



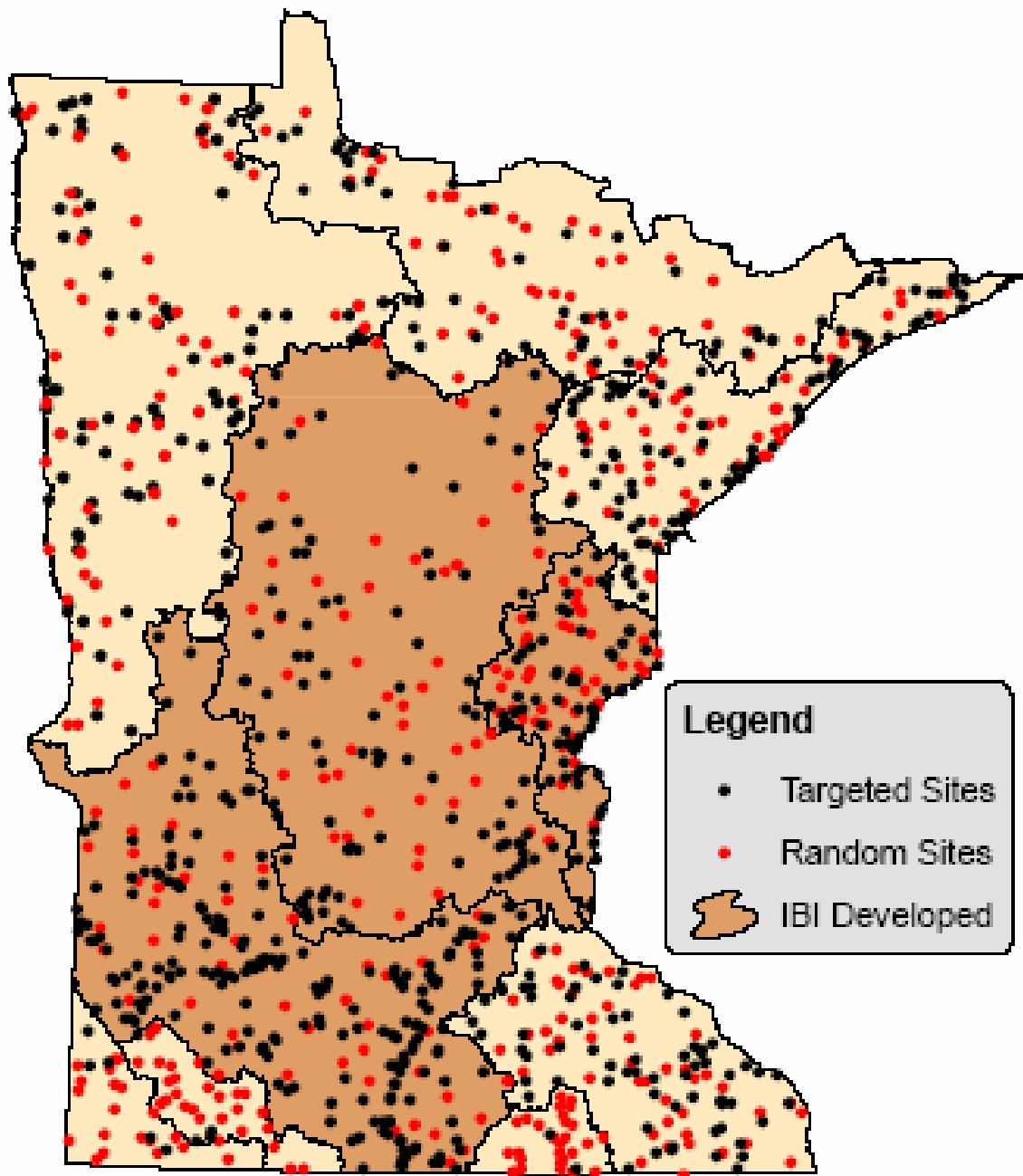
Great Rivers

- In Minnesota, we've always considered the lower Mississippi (lock and dam system) different.
 - Indicators
 - Sampling design
 - Reference condition
 - Assessment

Look forward to
EMAP-GRE results



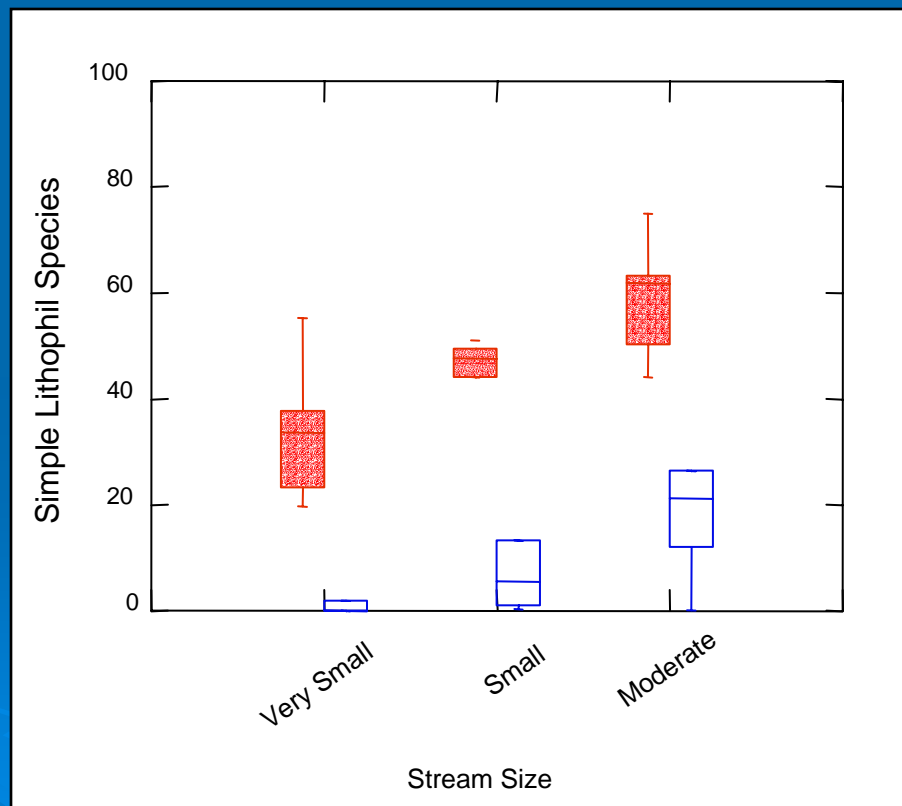
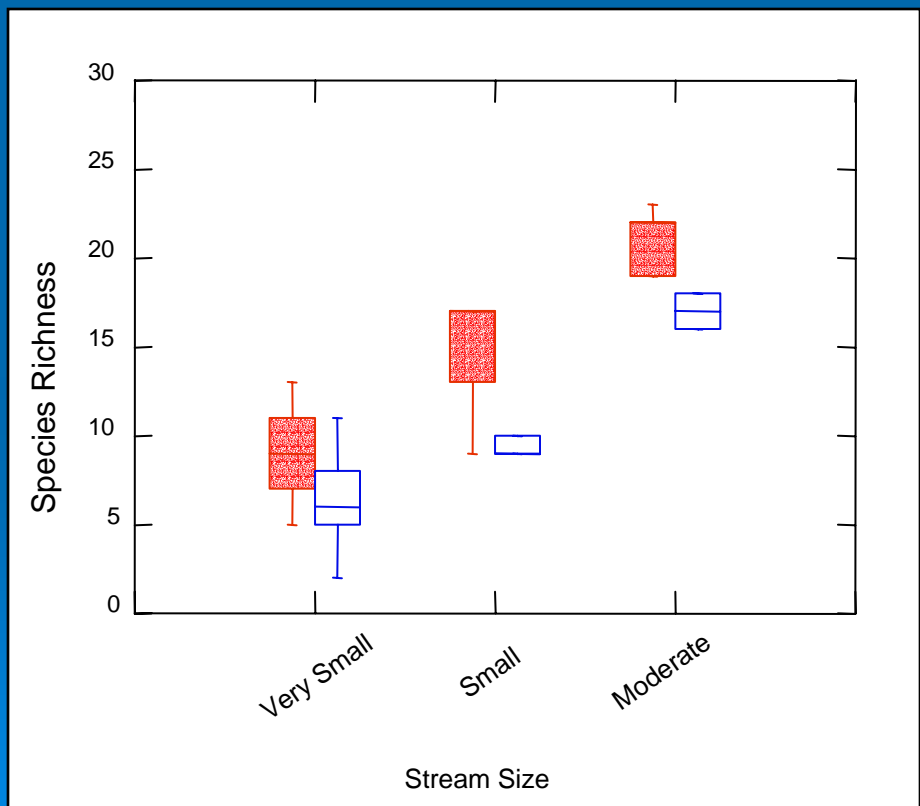




Legend

- Targeted Sites
- Random Sites
- IBI Developed





Upper Mississippi River Basin (Drainage Area >200 mi²)

