Presented at

Great Rivers Reference Condition Workshop

January 10-11, Cincinnati, OH

Sponsored by
The U.S. Environmental Protection Agency and The Council of State Governments

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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Great Rivers Reference Condition Workshop
Cincinnati, Ohio
January 10-11, 2006

Outline

➢ Very brief intro. to MPCA program

➢ Geographic framework

➢ Candidate site selection

➢ Reference determination

➢ Current status of program

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).

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
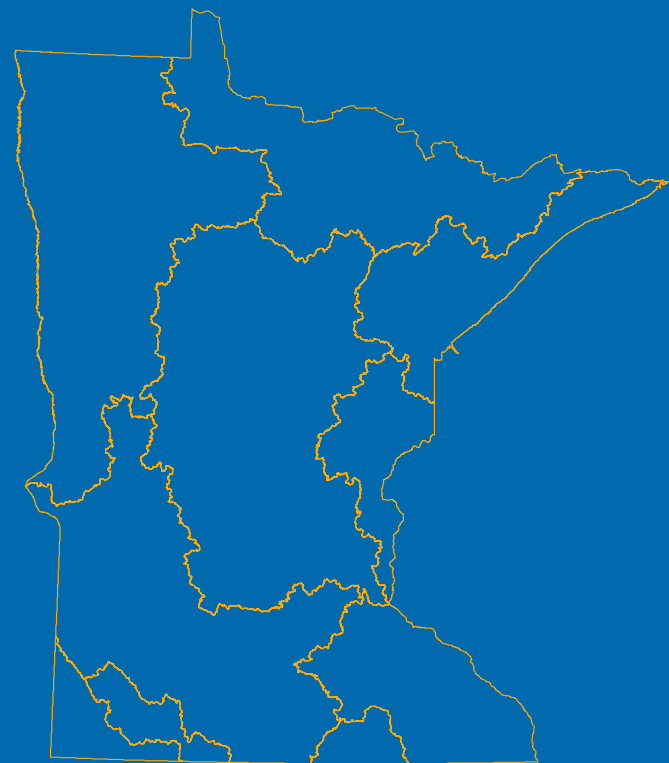
Stream Classification

➢ 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
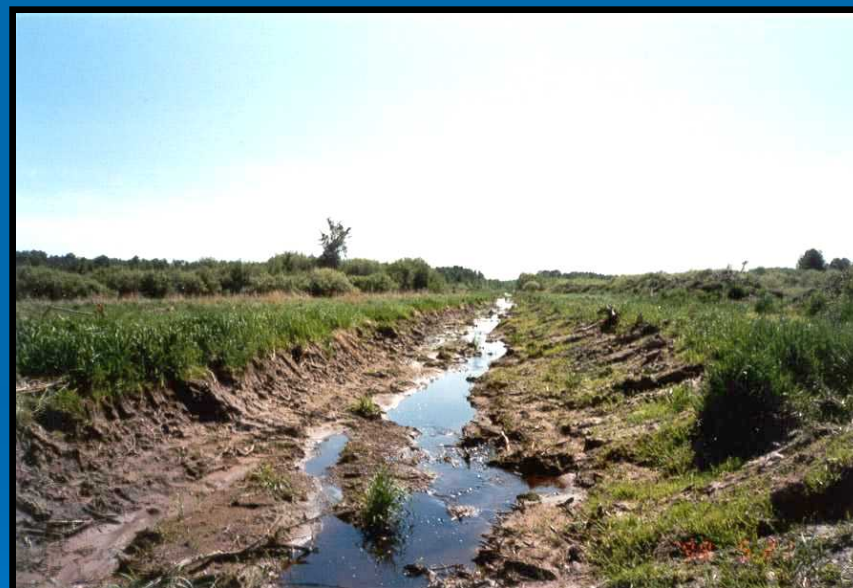
Available GIS Coverages (continued)

➢ 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
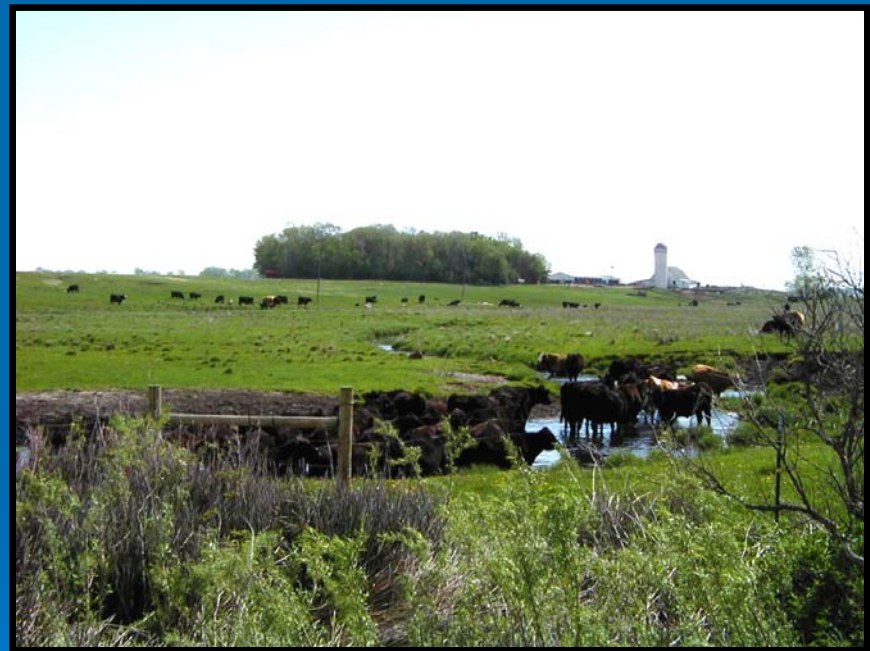
Reach level tools

➢ **Quality of the riparian zone and evidence of channelization**

- NLCD coverage
- DOQ's
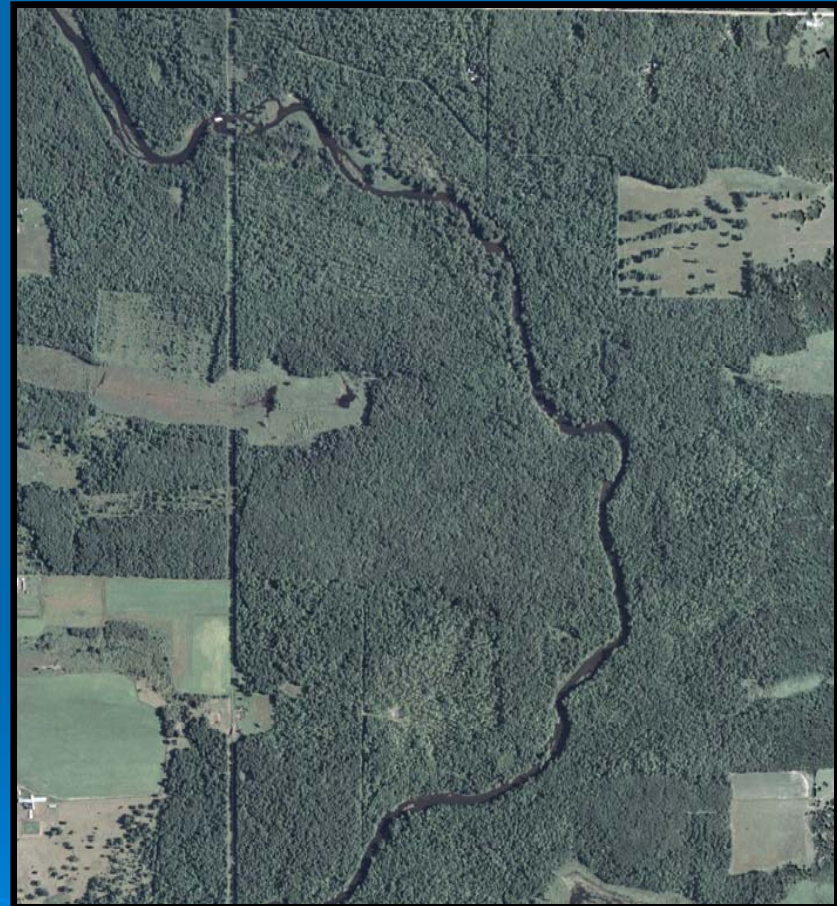
Watershed Disturbance Factors

- 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

Qualitative Scoring Criteria

➤ Rating based on size (extent) and proximity of stressor <u>relative to other sites in the basin</u> 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

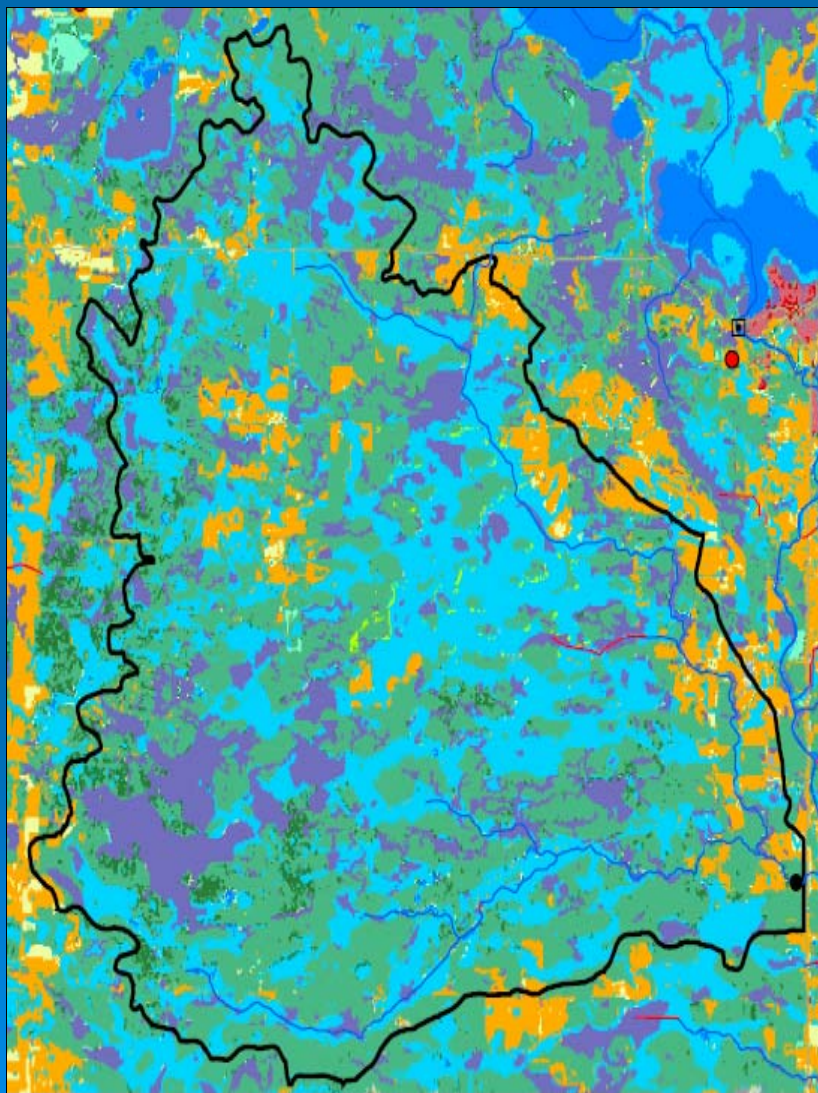# The Upper Mississippi River Basin Disturbance Gradient
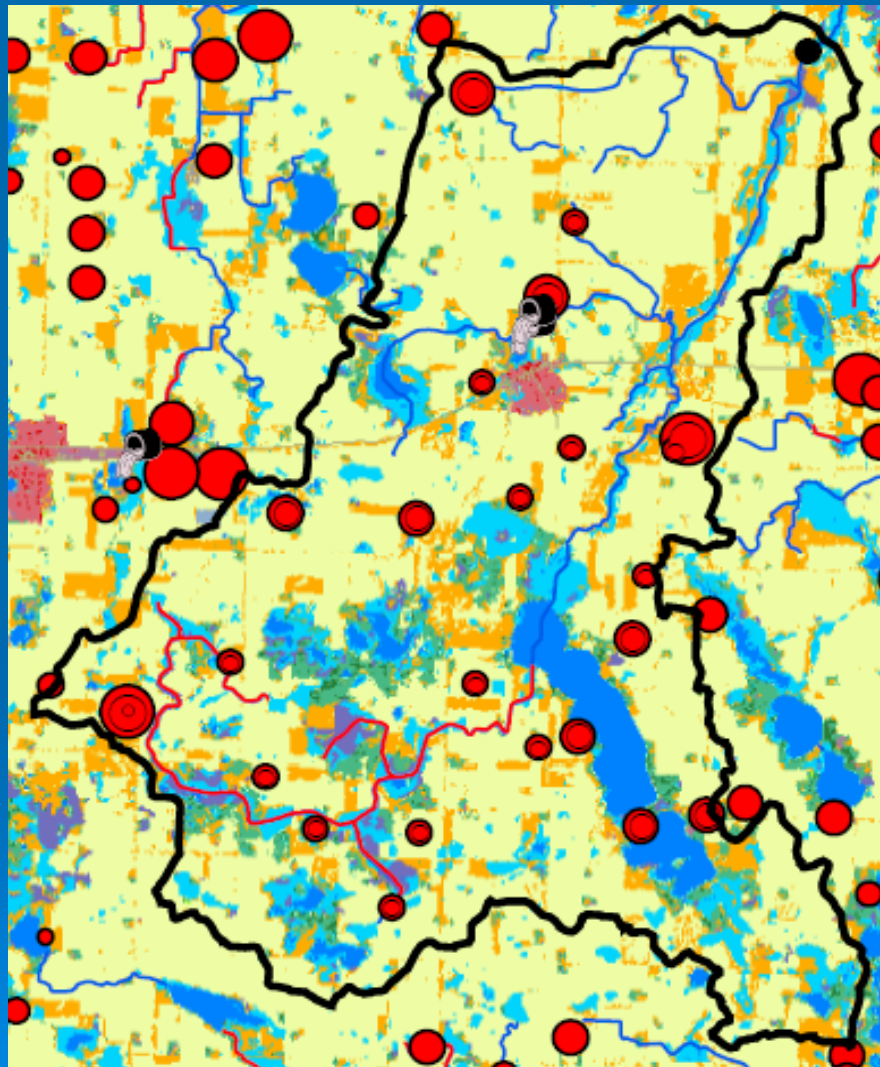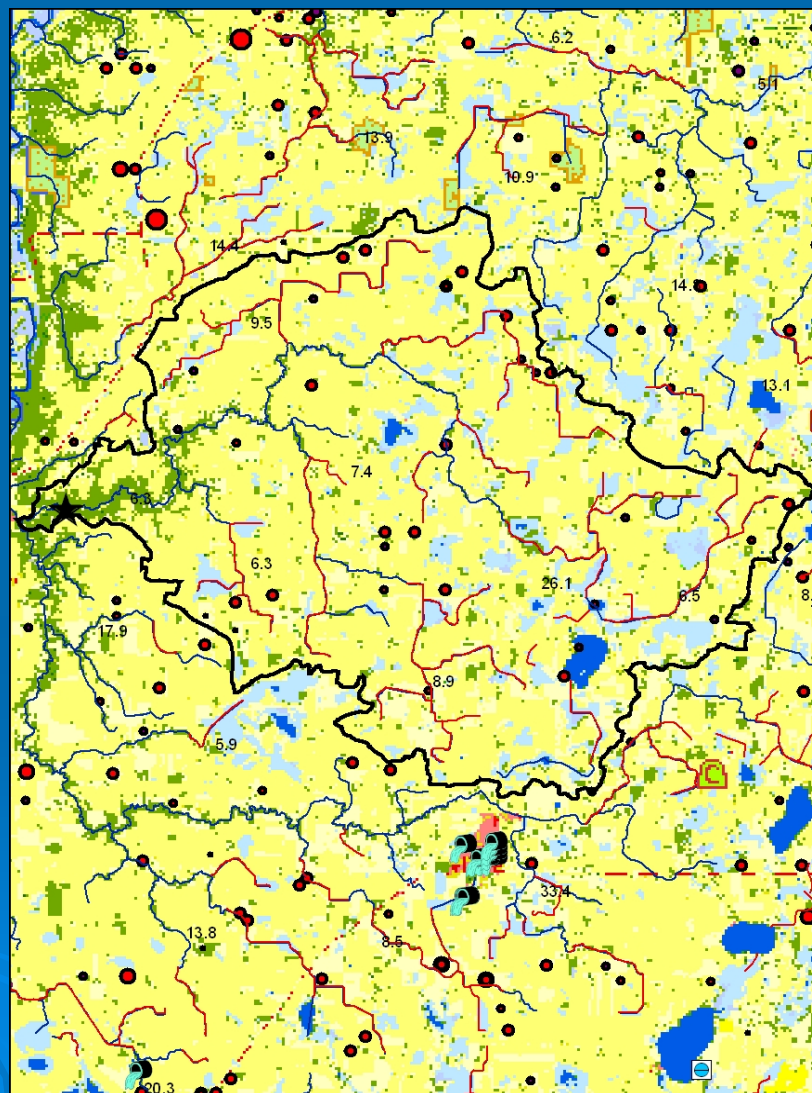
Grove Creek, UM Basin, NCHF Ecoregion
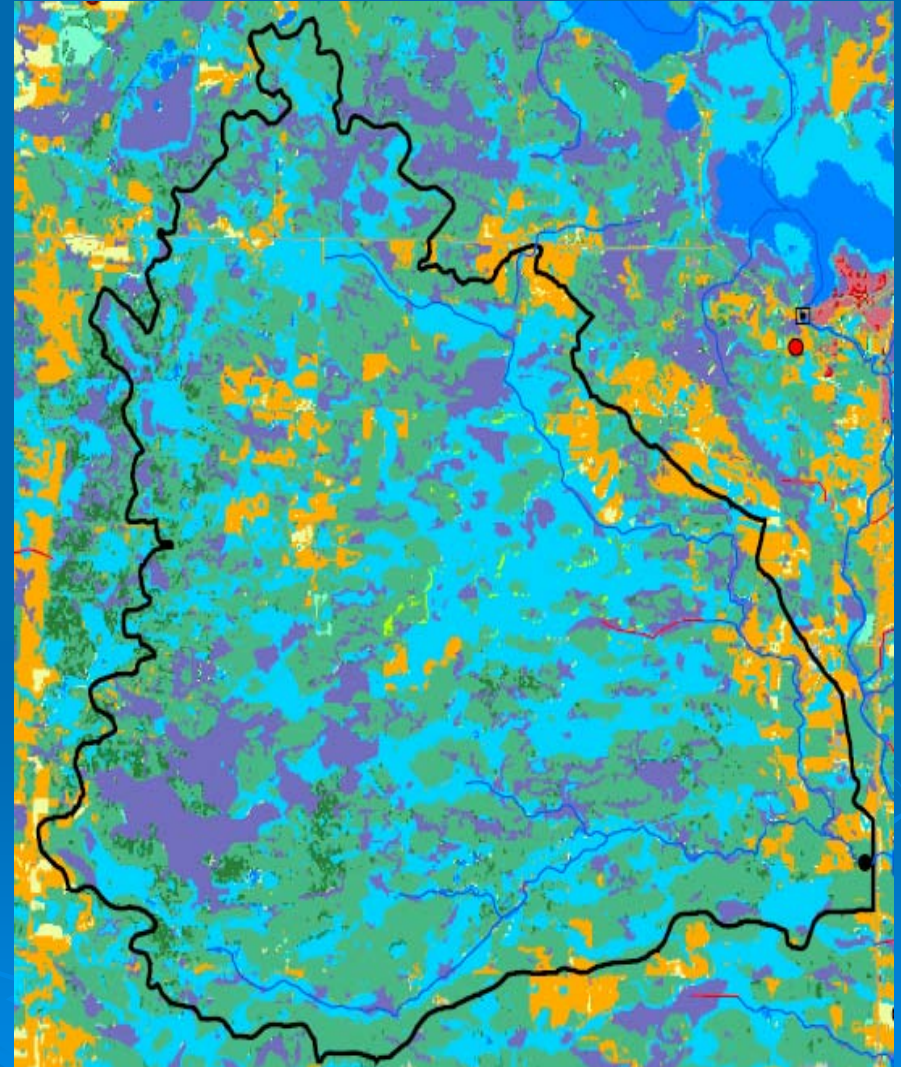
Bradbury Brook, UM Basin, NCHF Ecoregion

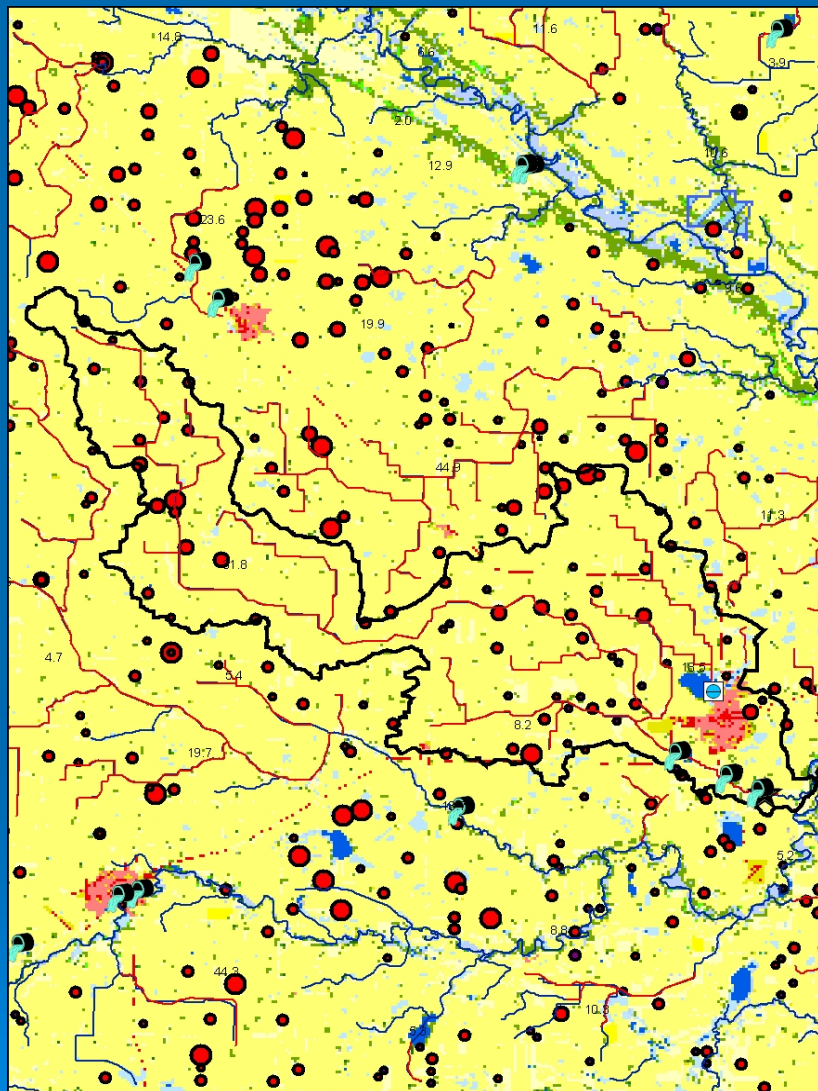# Regional Differences in Least Impacted
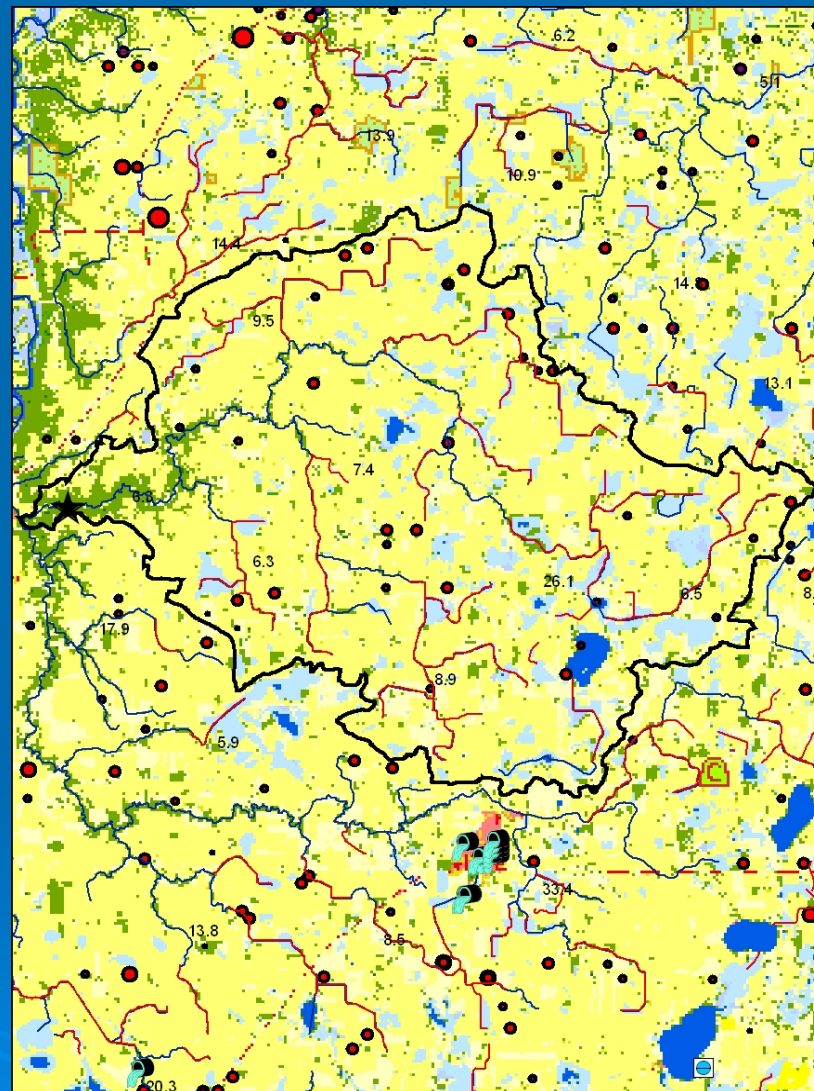
Bradbury Brook, Upper Miss. Basin

Forest Prairie Creek, Minnesota Basin

The MN River Basin Disturbance Gradient

JD #30

Forest Prairie Creek

Development of a rating system
(examples from the Upper Mississippi Basin)

STREAM NAME	DRAINAGE	URBAN	AGRICULTURE	FEEDLOTS	POINT SOURCE	DITCHING WATERSHED	RIPARIAN WATERSHED	RIPARIAN SITE	DITCH SITE	SUM OF RATINGS	OVERALL RATING
South Fork Crow River	208.00	4	0	1	3	0	0	0	Yes (0)	13	0
Rum River	1315.00	3	3	2	1	2	3	2	No (5)	21	3
Shingle Creek	13.00	0	5	5	5	1	1	3	0	25	0
Little Buffalo Creek	5.00	2	2	5	5	2	3	3	5	27	2
Briggs Creek	7.00	4	2	4	5	4	4	3	5	31	4
Shell River	610.00	4	3	2	5	5	3	5	5	32	4
Prairie River	220.00	4	5	5	4	4	5	4	5	36	5
Mississippi River	135.00	4	4	5	5	5	4	5	5	37	5
Third River	82.00	5	5	5	5	5	5	4	5	39	5
Pigeon River	4.00	5	5	5	5	5	5	5	5	40	5
Nicollet Creek	38.00	5	5	5	5	5	5	5	5	40	5

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 mi^2 drainage area)

> ## Small streams

- Watershed rating over 27

- Habitat rating of $\geq$ 6 (0 to 12 range)

- 15 of 40 sites considered reference quality

Kettle Creek (Becker County)

Upper Mississippi River Basin
Reference sites (35-200 mi^2 drainage area)

➢ Moderate size streams

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

Schoolcraft River (Hubbard County)
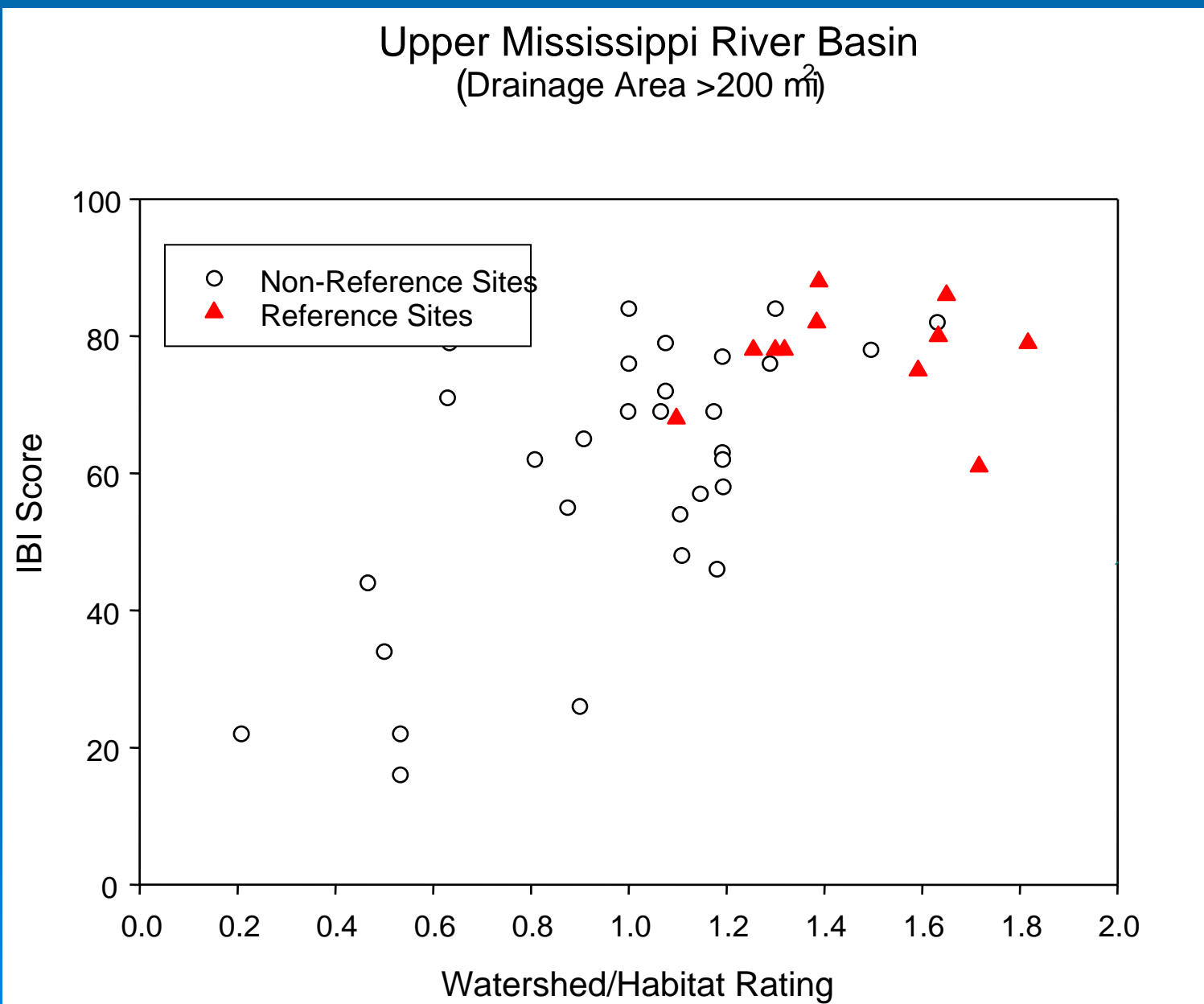
Upper Mississippi River Basin
Reference sites (>200 mi^2 drainage area)

➢ 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
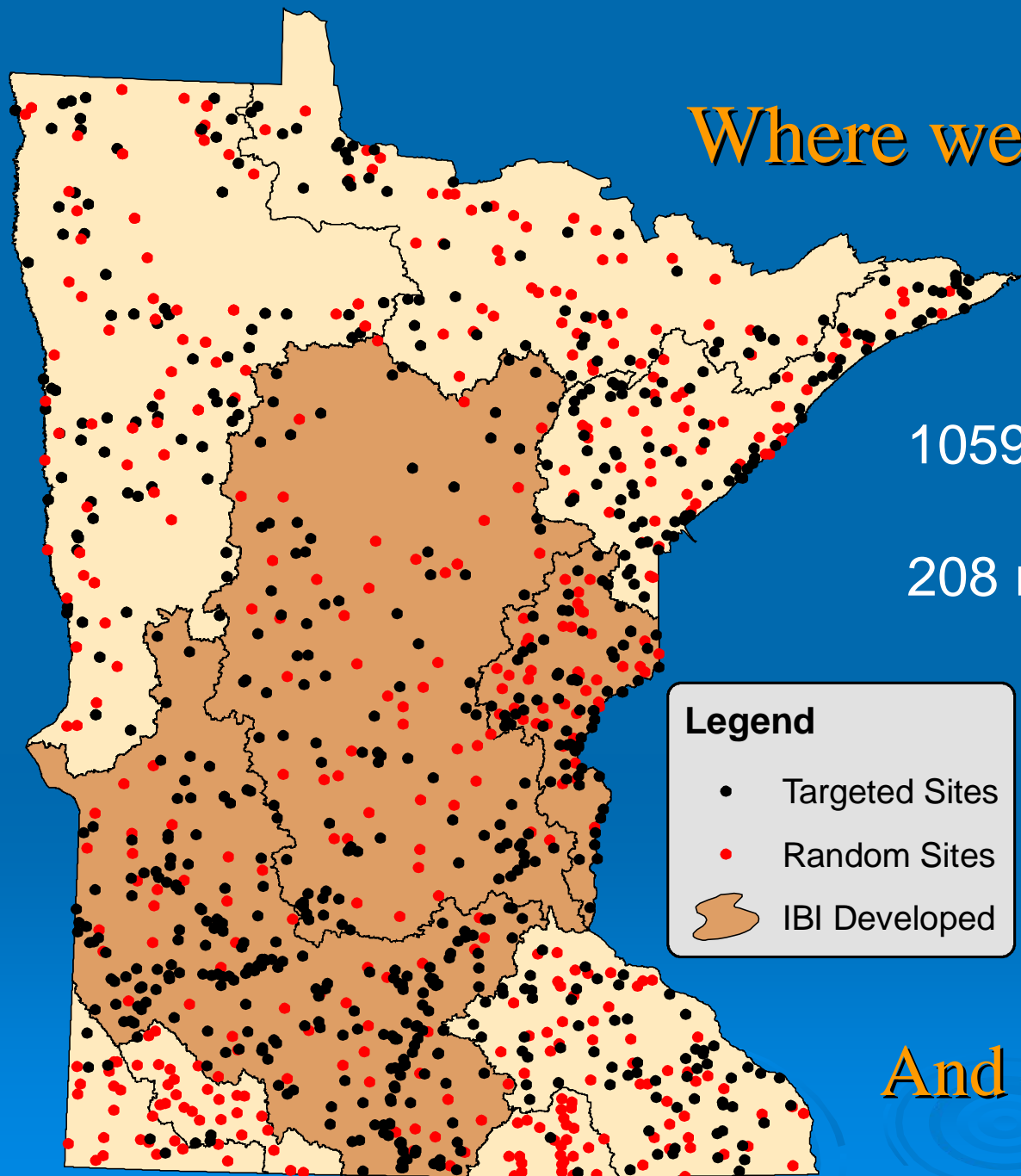(Drainage Area >200 mi^2)

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…?)
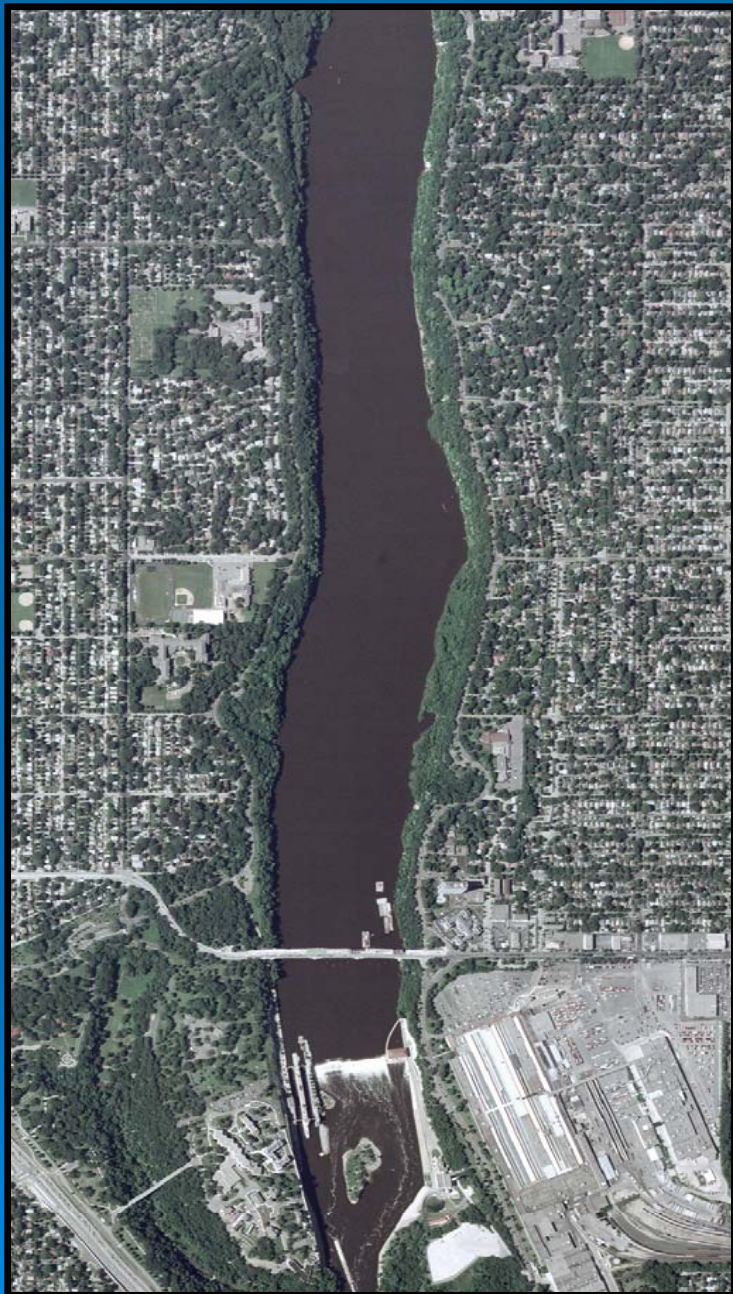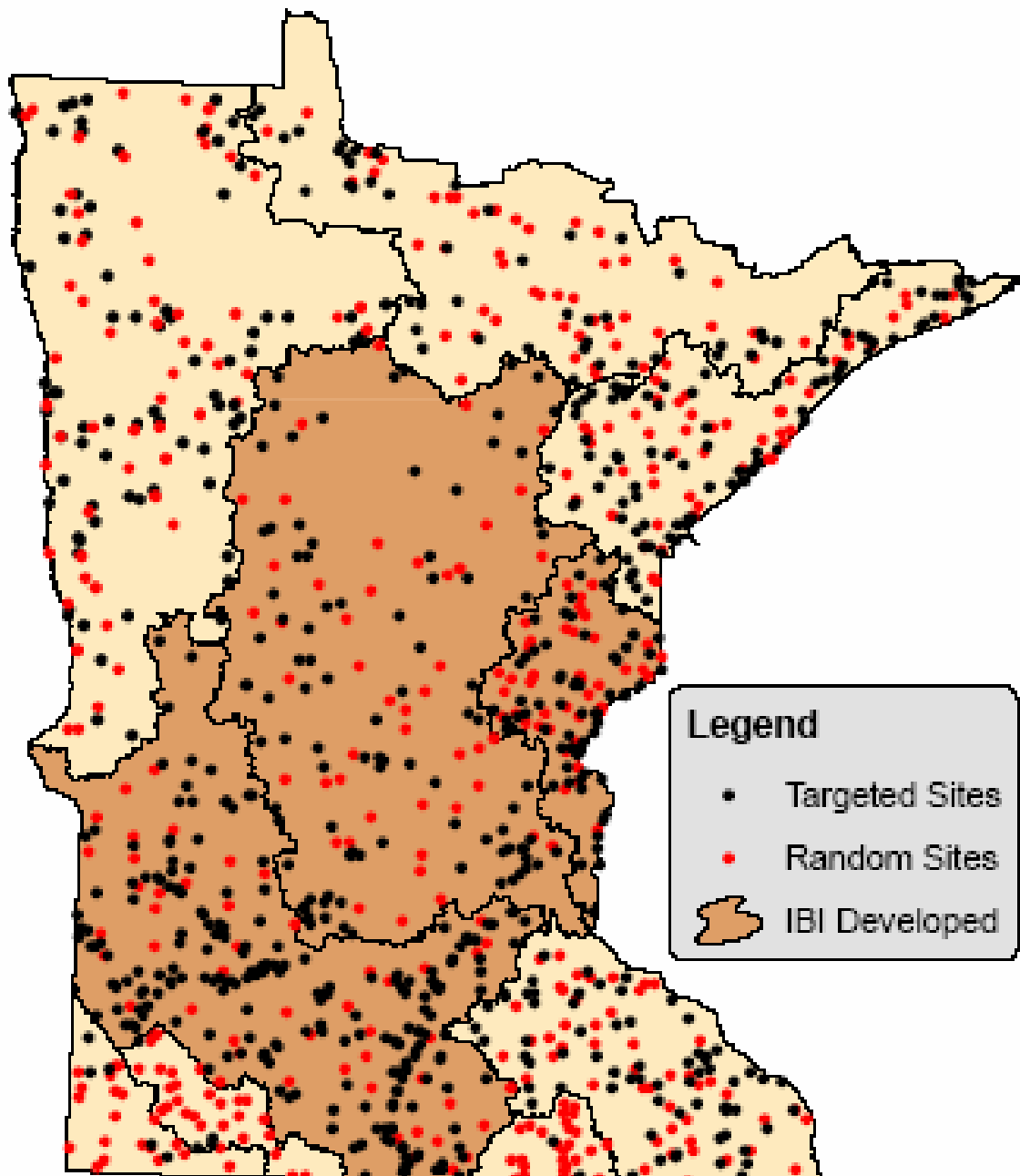
Great Rivers

➢ In Minnesota, we've always considered the lower Mississippi (lock and dam system) different.

- Indicators
- Sampling design
- Reference condition
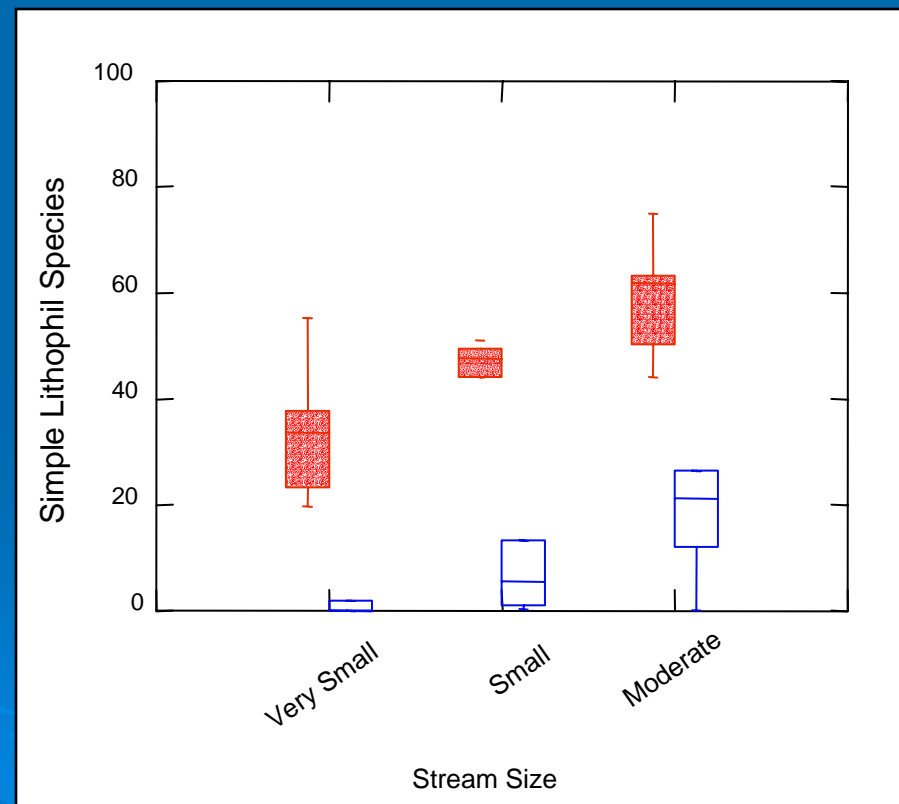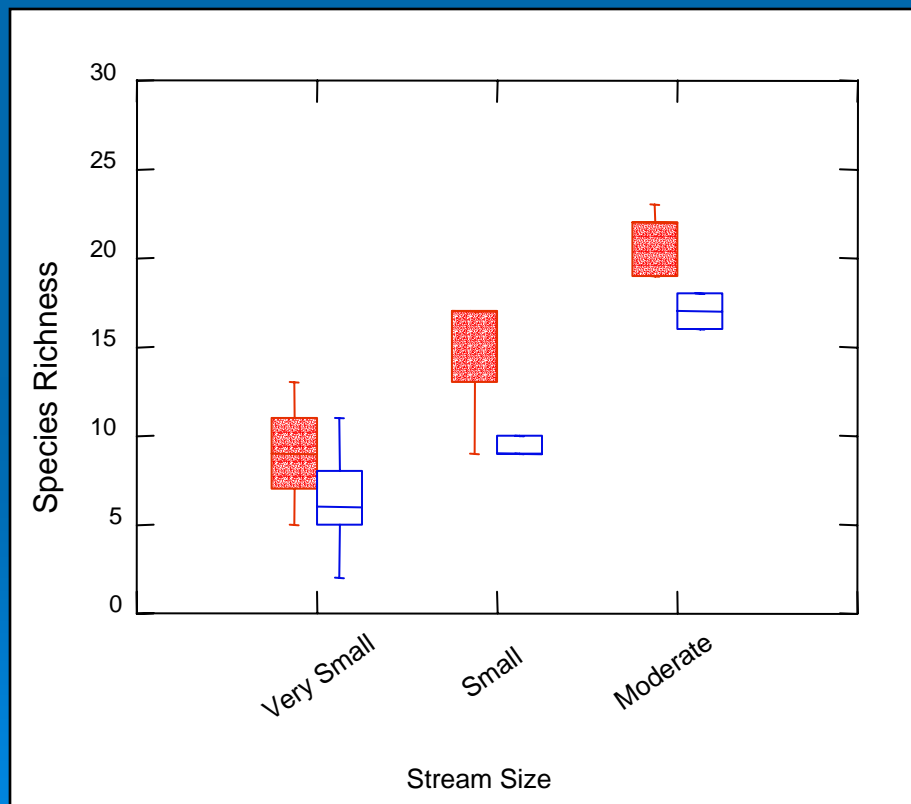- Assessment

Look forward to EMAP-GRE results

Legend

- Targeted Sites
- Random Sites
- IBI Developed

Upper Mississippi River Basin
(Drainage Area >200 mi^2)

Scatter plot. X-axis: Watershed/Habitat Rating (0.0 to 2.0). Y-axis: IBI Score (0 to 100). Legend: ○ Non-Reference Sites, ▲ Reference Sites. A horizontal dashed line at 61. A hatched band spans approximately 47 to 74.