Implications of inter-habitat variation for monitoring Great River ecosystems: the EMAP-UMR experience

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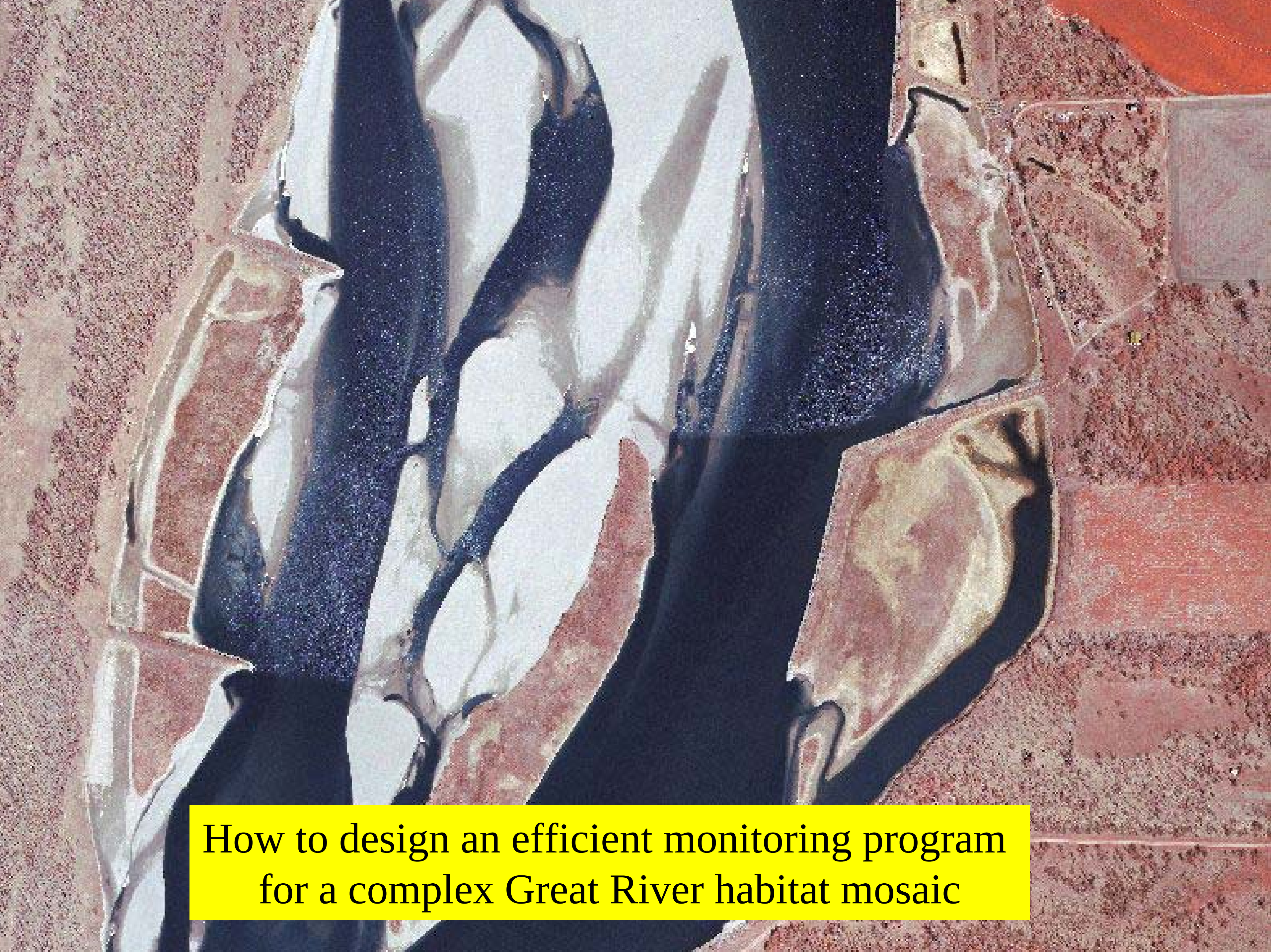
Great River Ecosystems

- Are dynamic mosaics of habitats that vary at multiple spatial scales
- GRE monitoring designs/programs can capture some but not all variation among habitats
- GRE monitoring design process requires decisions about which habitats to monitor


How to design an efficient monitoring program
for a complex Great River habitat mosaic

Three choices for each habitat

1. Monitor habitats separately (separate design)
2. Combine habitats for monitoring
3. Omit habitats from monitoring

In EMAP, its always possible to monitor more habitats separately, but the costs go up fast

Candidate Garrison Reach Habitats

Open water
- main channel
- secondary channel
- tertiary channel

Backwater
- Connected backwater
- unconnected backwater
- backup
- scour pool
- dredged backwater
- jetty backwater
- natural backwater
- delta backwater
- backwater wetland

Shorelines
- wetted margins
- bar and island margins
- channel margins

Inside Bend

Outside Bend

Straightaway

Crossover

Selected Garrison Reach Habitats

Open water

- main channel
- Secondary channel
- tertiary channel

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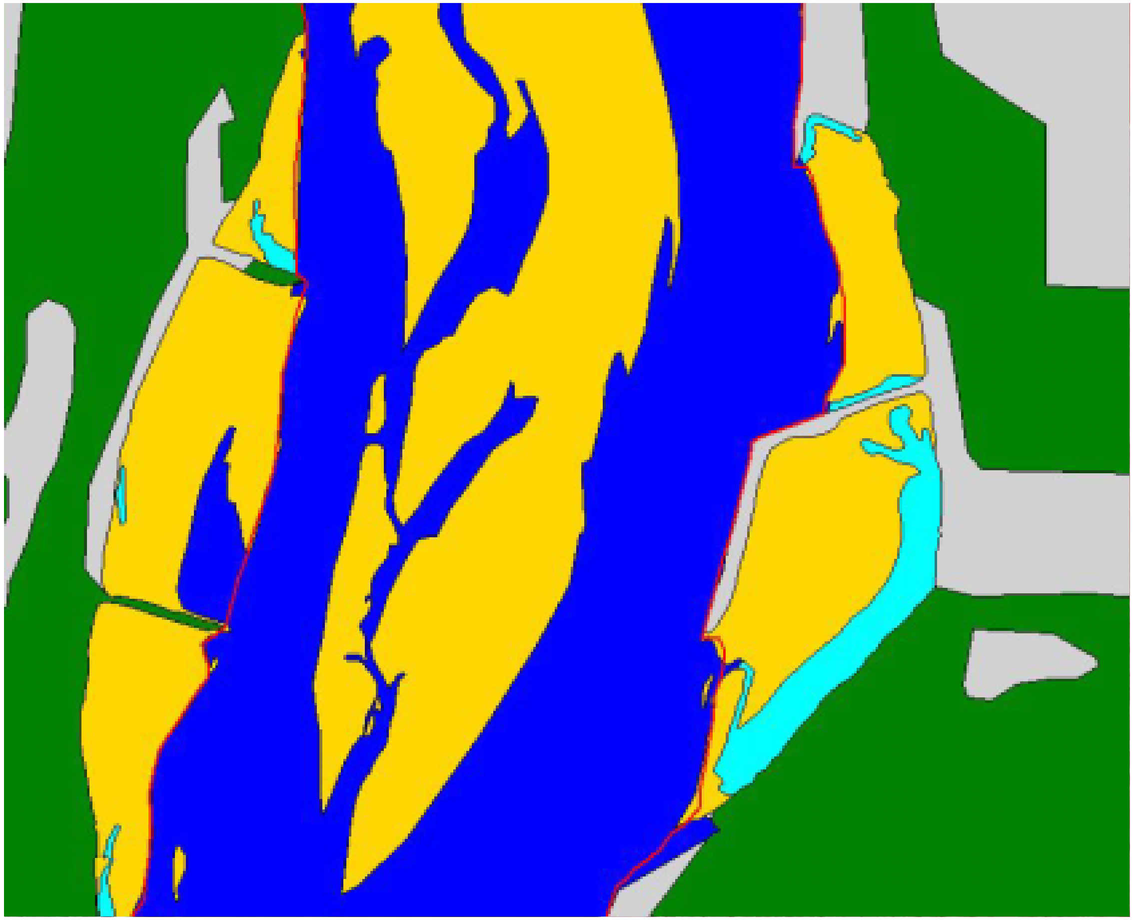


Many things can vary among GR habitats

- Variance structure of indicators
- Stressor rankings
- Assessment needs
- Ecosystem services
- Advocates
- Sampling efficiency
- Response to restoration

EMAP-UMR aquatic habitats

	Open Water	Backwaters	Shorelines
Primary stressor	Flow regulation	Local (runoff)	Bank stabilization
Response design	PONARS at a point	PONARS at a point	Kicks on a transect
Assessment needs	% (area) UH for T&E Fishes?	% (area) WQ impaired?	Kilometers of bank stabilized?
Sample frame	Area	Area	Linear

	Open water	Backwaters	Shorelines
Ecosystem services	Sport fishery GR fish habitat	Fish rearing 2^{0} production Denitrification	OM input Alluviation
Vocal stakeholders	Anglers Rec boaters	Riparian land owners Marina ops	Developers Farmers
Response to restoration of ecosystem function	Fastest?	Slower?	Slowest?

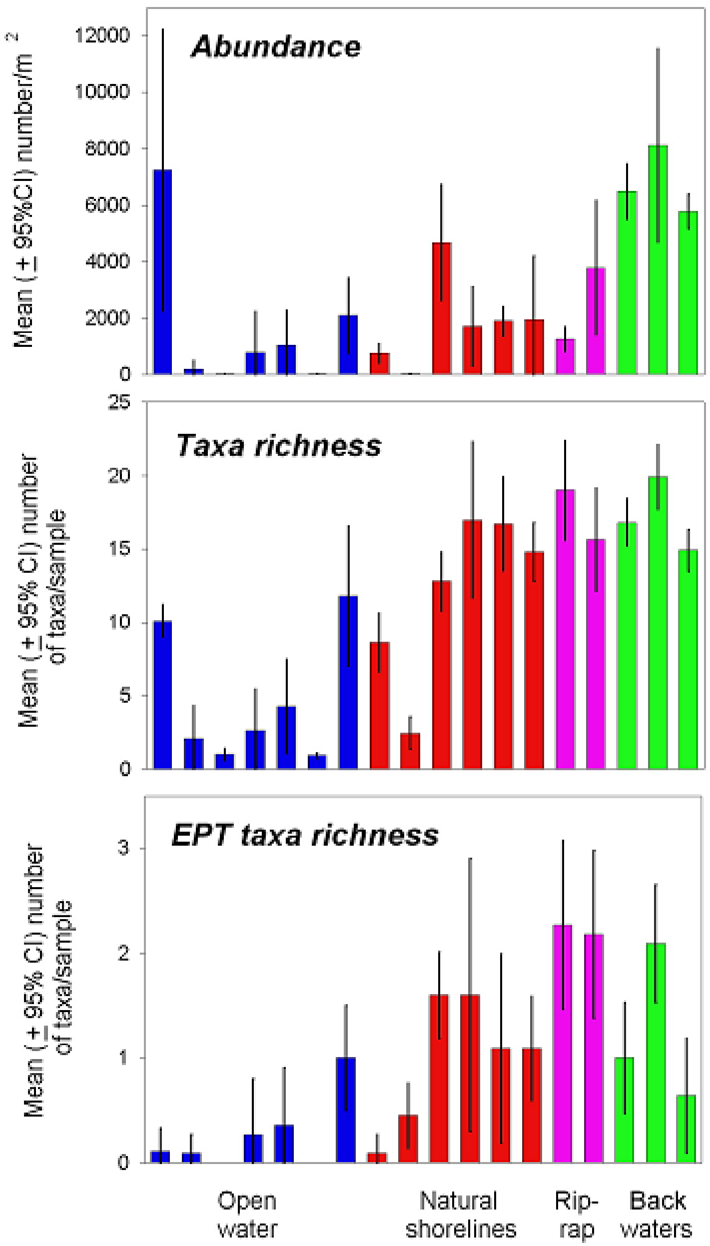

Backwater:
•Small area but high productivity
Open water:
•Low productivity but vast area

Shorelines:

- Effect of SL modification is key GR assessment question
- Links aquatic to riparian conditions

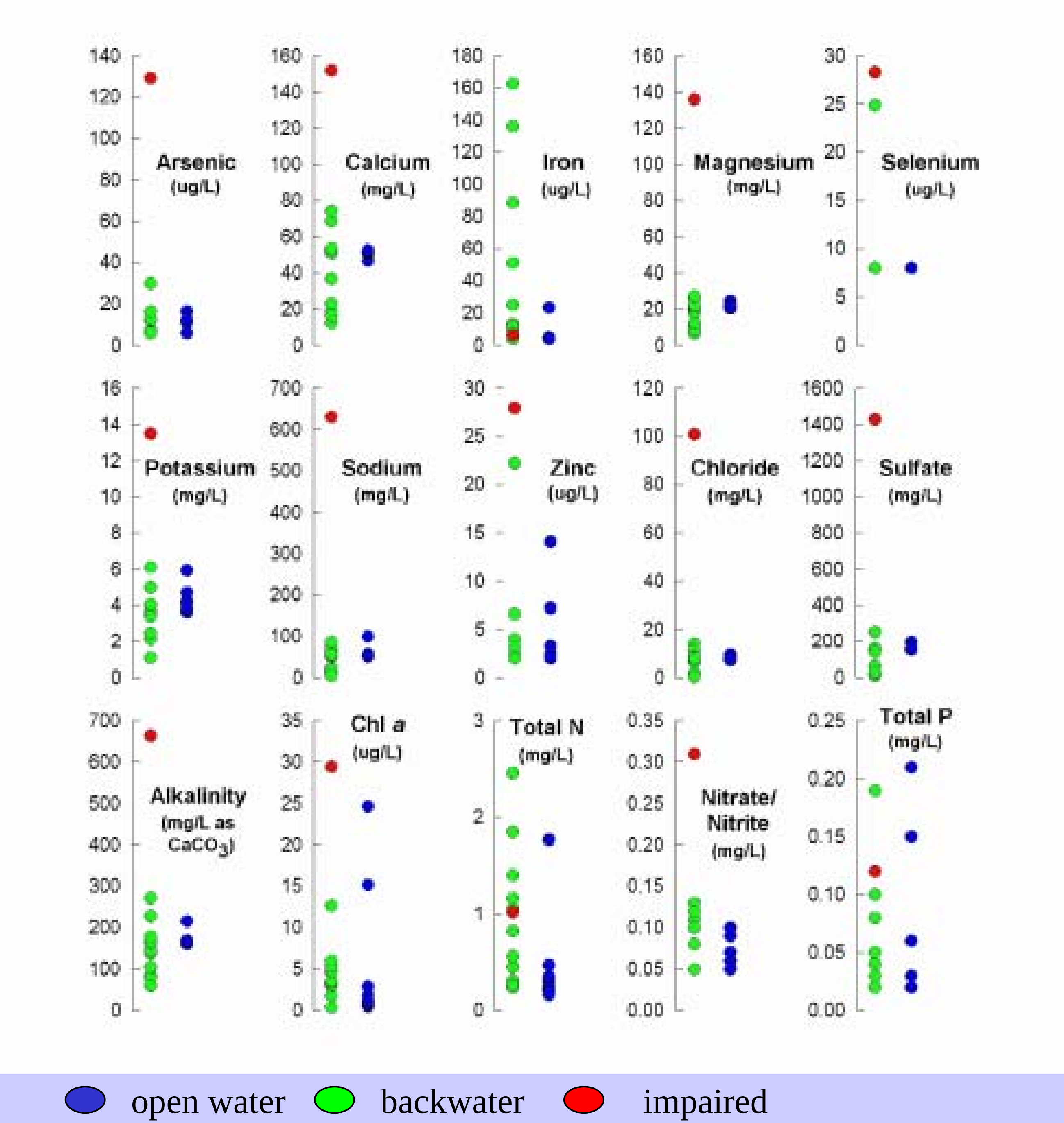
EMAP-UMR decisions

- Separate design
  - Backwaters, open water, shorelines, terrace forests, in-channel riparian habitat
- Combined habitats
  - Unconnected + connected BW; primary + secondary channels; dredged + natural backwaters; modified + natural shorelines; vegetated + unvegetated bars; open water + tailwater…
- Omitted from design
  - Tributaries, non-forest floodplain habitat, secondary shorelines, delta backwaters



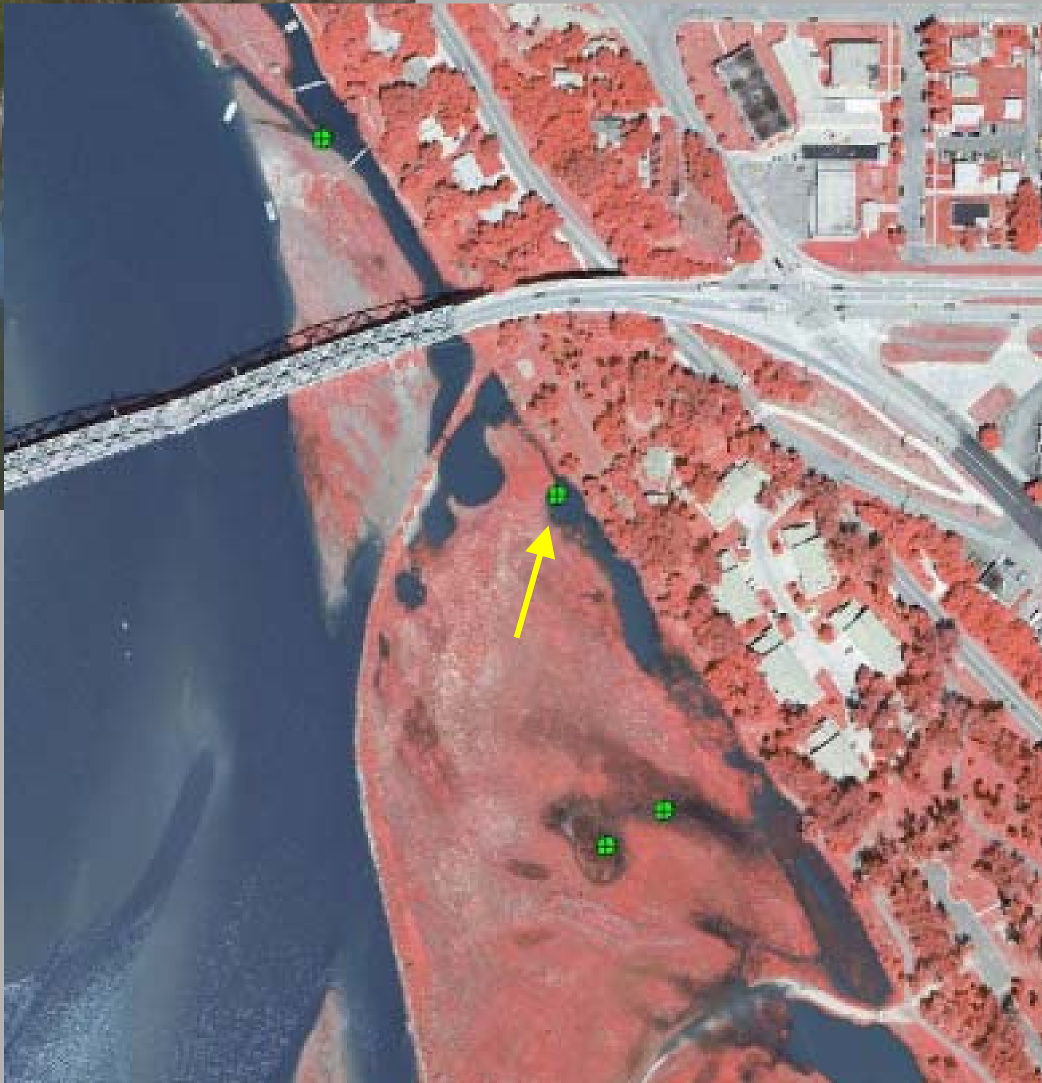
Effect of Habitat Type on Benthos

- Different variance structure
- Different reference condition
- Different IBI metrics
- Variation among habitats may exceed variation in condition within habitats



Sampling habitats as separate populations can produce different assessments

2001 WQ data



UMR BW site 49

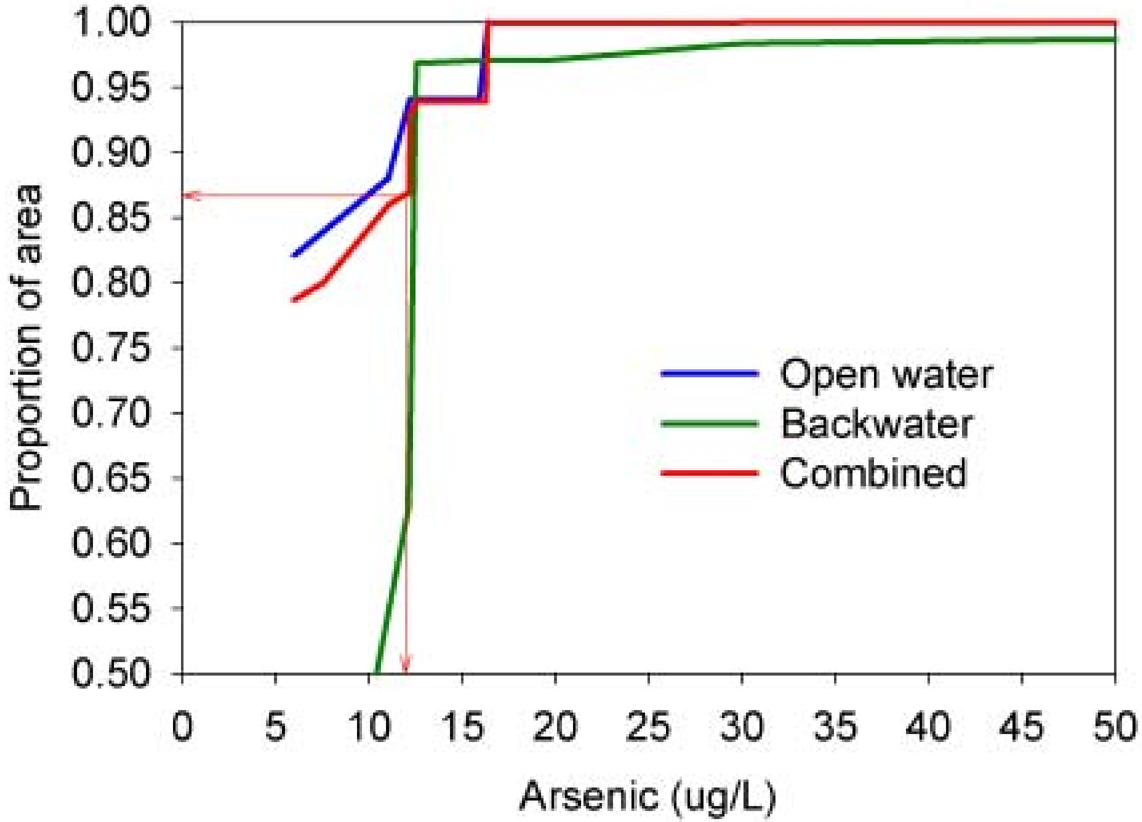
Ar = 129 ug/L

Al = 114 ug/L

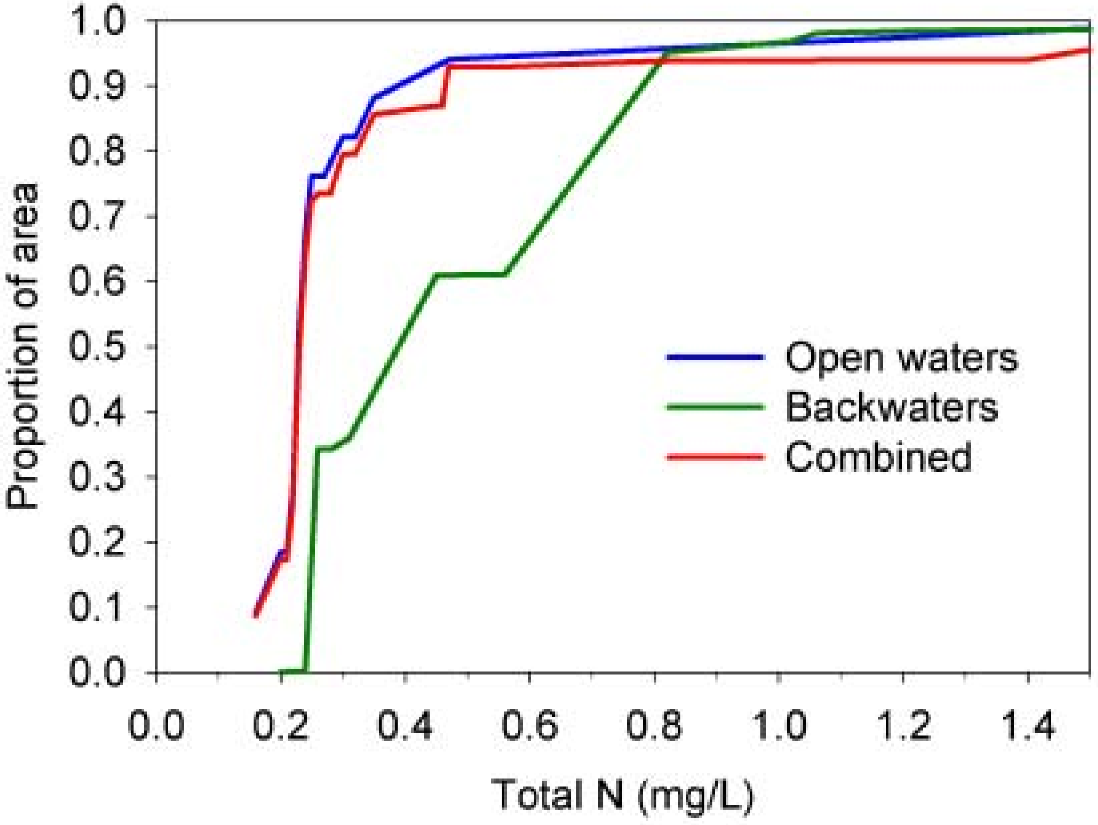
Na = 632 mg/L

Sulfate = 1430 mg/L

In combined assessment, <15% of the area has >12 ug/L arsenic



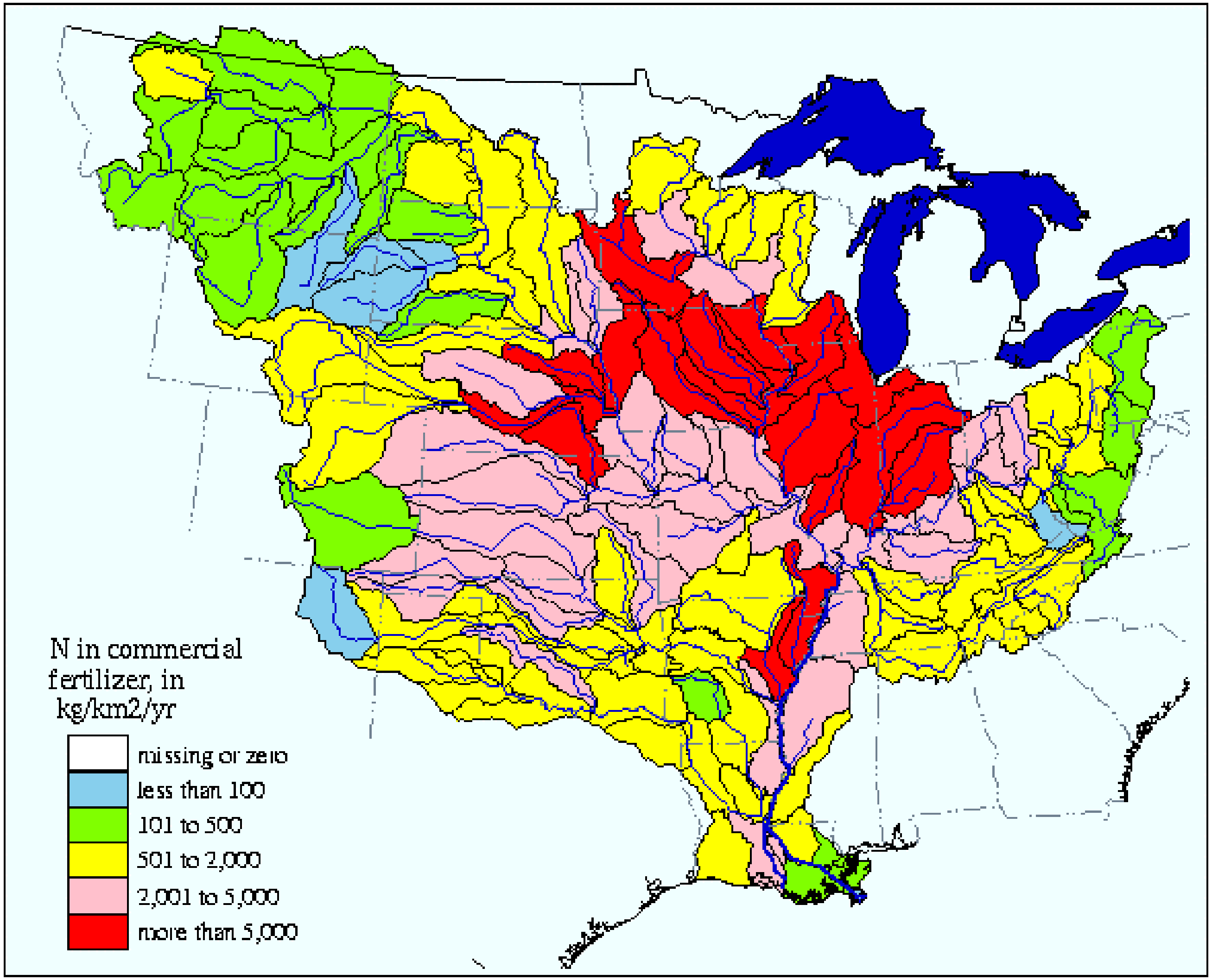
Open water condition dominates combined assessment



EMAP-UMR Backwater definition

- Enclosed or semi-enclosed non-running open water (not marsh) of any size
- Connected <u>or</u> unconnected to river at time of sampling
- Within current floodplain
- Unimpounded
- Not part of Lake Oahe (>RM 1285)

Designing a multi-resource EMAP-GRE for the CB



Lots of design possibilities

- Very complex designs are possible
- Open water population on a linear frame (305b)
- Open water population on an area frame (EMAP-UMR)
- Open waters + backwaters + ???
- Multiple spatial and temporal scales possible

<u>All</u> EMAP designs produce statistically sound assessments of condition – they just vary in cost and in usefulness to stakeholders

Selection of resource populations:

- Must be driven by assessment questions
- Strongly constrained by available resources
- Constrains integration and interpretation of results

Which criteria are most important?

red = yes; 2 pts pink = maybe; 1 pt black = probably not; 0 pts	Open water	Backwater	Shoreline	Chute	Tailwater	Nav channel	In-channel riparian
Strong AQ advocacy?	?	?	?	?	?	?	?
Universality in space (reaches)?							
Identifiable on frame?						?	
Great River TMDL relevant?			?	?		?	
G							
Integration with EMAP-UMR?							
Integration with EMAP-SW?							
T&E fish species habitat?							
Restoration of ecosystem function?					?	?	
Score	15	9	12	7	6	1	9

EMAP-GRE designs should support adaptive management for restoration of ecosystem function

Karl Bodmer, “Snags on the Missouri” 1833