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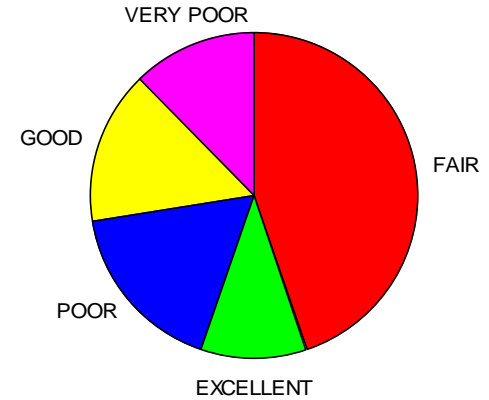
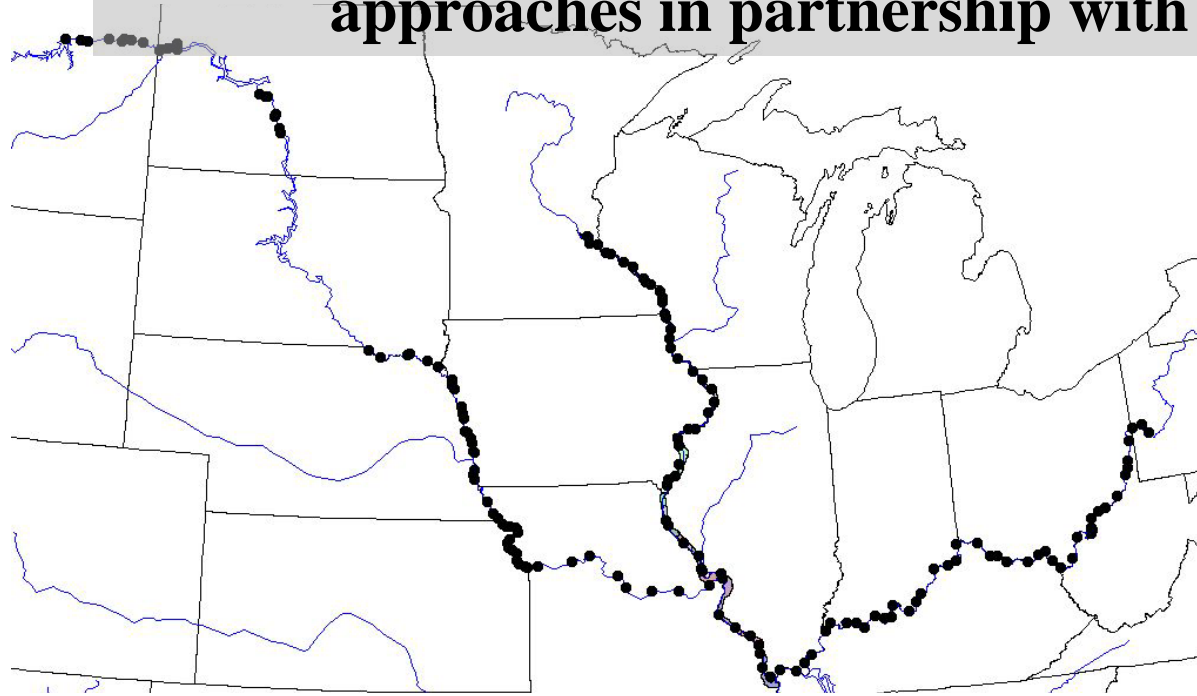
## **Environmental Monitoring and Assessment of Great River Ecosystems (EMAP-GRE)**

### **Design considerations & Discussion for Implementation on the Lower Mississippi River**

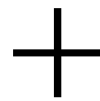
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<http://www.epa.gov/emap/greatriver>

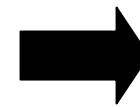
*EMAP develops, demonstrates, and transfers assessment approaches in partnership with states & regions.*



Designs



Indicators



Assessments

Sample size



Schedule



Assessment units



Resource definition

Implementation



Training & QA



Consensus & evaluation

Bioassessment Framework



Cooperative data analysis



Standards & criteria



Partnerships

# EMAP-GRE works

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## Pro:

- Representative sampling of extant conditions.
- Numerous & relevant water chemistry, habitat, biological variables.
- Methods are consistent and reasonable.
- Contributes to reference condition characterization and indicator development.

## Con:

- Bioassessment frameworks undeveloped.
- Approach not optimal for all needs.
- Limited site-specific, before-after, control-impact inferences.

EMAP is a research program, not an ambient monitoring program.  
It *does* improve assessment science.

It *can* improve assessment practice.

An interstate & Regional assessment forum would be invaluable.

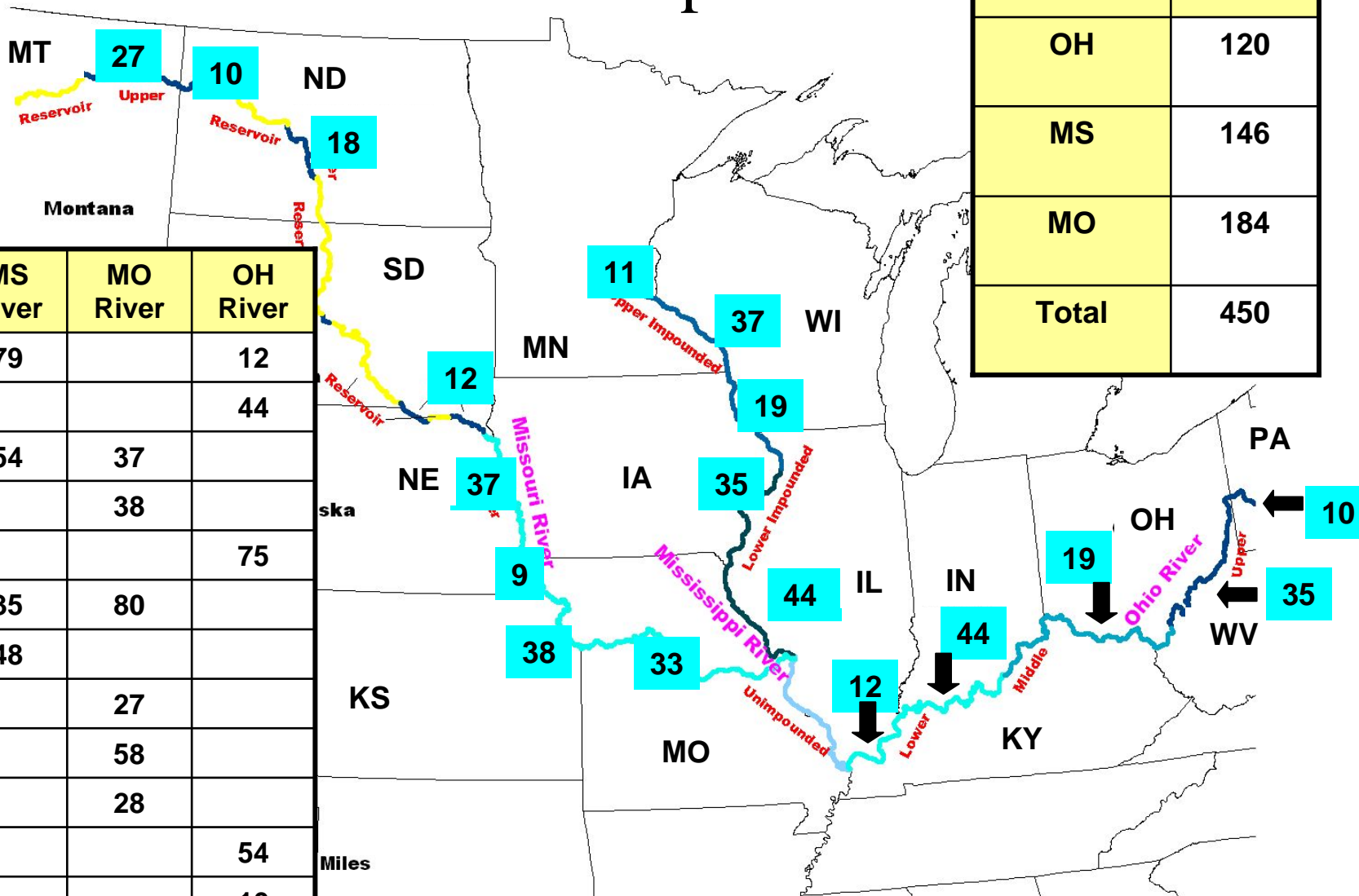
# Design considerations for the Lower Mississippi River

- **Objectives**
  - Partner-defined
  - Relevant to priority water quality and biological issues of river(s).
- **Assessment units**
  - Definable within explicit spatial domains (e.g. in a GIS)
  - Reasonable to complete assessment via EMAP and state/regional actions
- **Sample size**
  - Must be rationale & practical (N \* number of units \* number of resources)
  - Sampling across years must consider inter-annual variability.
  - Must include sufficient reference sites
- **Response Design (methods & indicators)**
  - Must be relevant to objectives
  - Should incorporate EMAP-GRE methods
  - Limited opportunity to develop new methods.
  - Must be consistent. Consensus and training are important.
- **Analytical Frameworks**
  - Should be identified early so needs are met by sample and response designs.

# Assessment Units & Sample Sizes

River	Sites
OH	120
MS	146
MO	184
<b>Total</b>	<b>450</b>

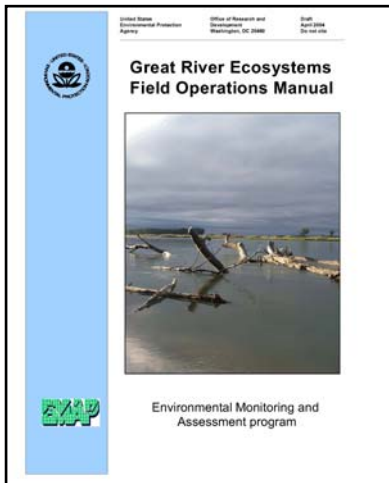
State	MS River	MO River	OH River
IL	79		12
IN			44
IA	54	37	
KS		38	
KY			75
MO	35	80	
MN	48		
MT		27	
NE		58	
ND		28	
OH			54
PA			10
SD		12	
WV			32
WI	37		



Upper Mississippi River System  
2004-2006

# Metrics and Indicators (Response Design)

- EMAP Field Manual at [www.epa.gov/emap/greatriver/fom](http://www.epa.gov/emap/greatriver/fom)



- **Water Quality**

- Dissolved oxygen
- Dissolved N (NO<sub>x</sub>, ammonia)
- Conductivity
- pH
- Metals (As, Pb, Se, CU, Fe, Ni)
- Temperature
- Anions & Cations
- Turbidity, suspended matter
- Alkalinity
- Total & Dissolved P, N, & C
- Elemental particle analysis
- Particulate stable isotopes
- Chlorophyll

- **Sediment**

- Enzyme activity
- Toxicity
- Total and volatile matter
- Chemistry

- **Biotic Assemblages**

- Fish
  - Tissue contaminants
  - DNA
- Invertebrates
  - Littoral benthos
  - Snags
- Zooplankton
- Phytoplankton
- Periphyton
- Submersed aquatic vegetation

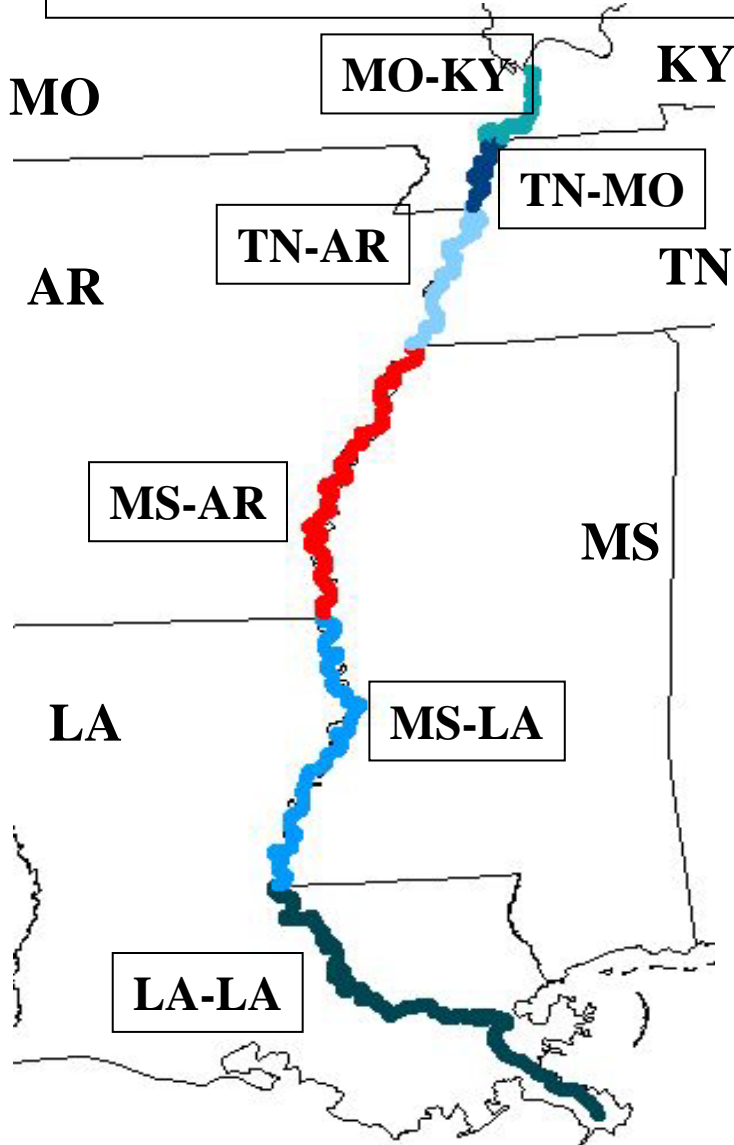
- **Habitat**

- Littoral
  - Vegetation cover
  - Substrate
  - Woody debris
- Riparian
  - Vegetation cover
  - Invasive/exotic species

# Example: Distribute sites by State with min N = 30

Sites within a state are distributed proportionally to interstate section length.

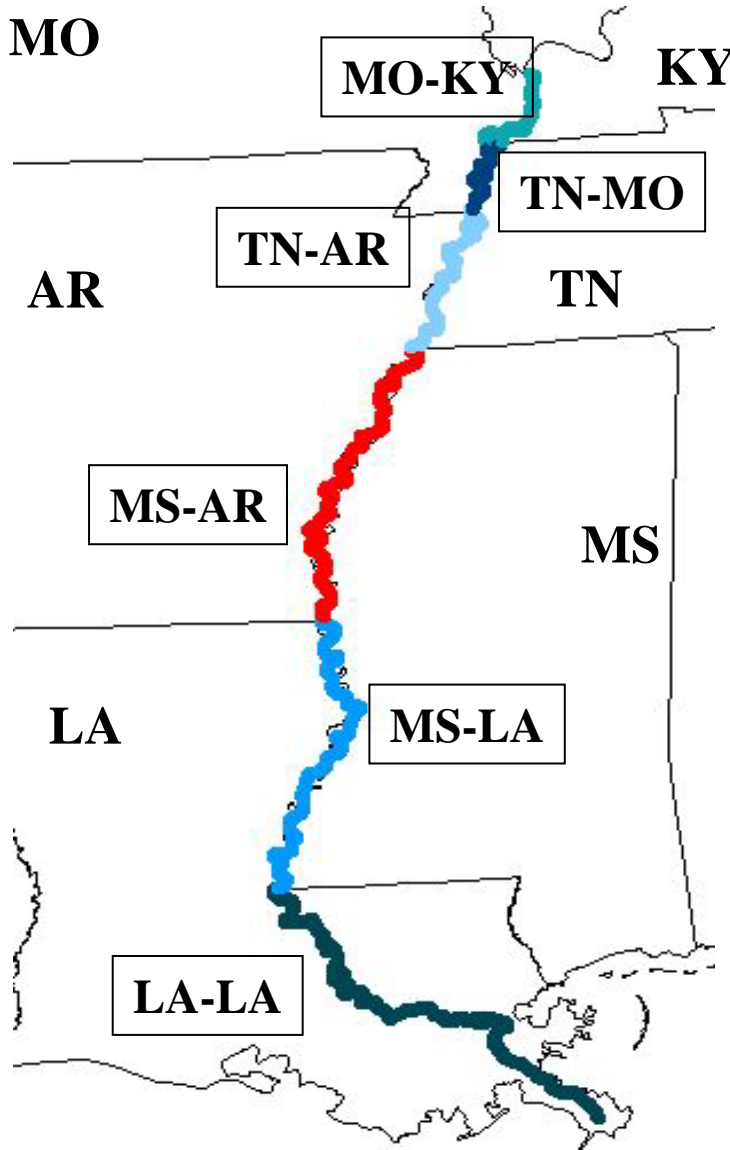
Data from interstate sections are used to assess the river for both states.



State	Length (km)	shares with	% of sites	Sampled Sites	State sites
LA	808				30
		LA	60%	18	
		MS	40%	12	
AR	515				30
		MS	65%	20	
		TN	35%	10	
MO	200				30
		KY	50%	15	
		TN	50%	15	
KY				15	30
MS					32
TN				5	30
<b>TOTAL</b>	<b>1526</b>			<b>110</b>	



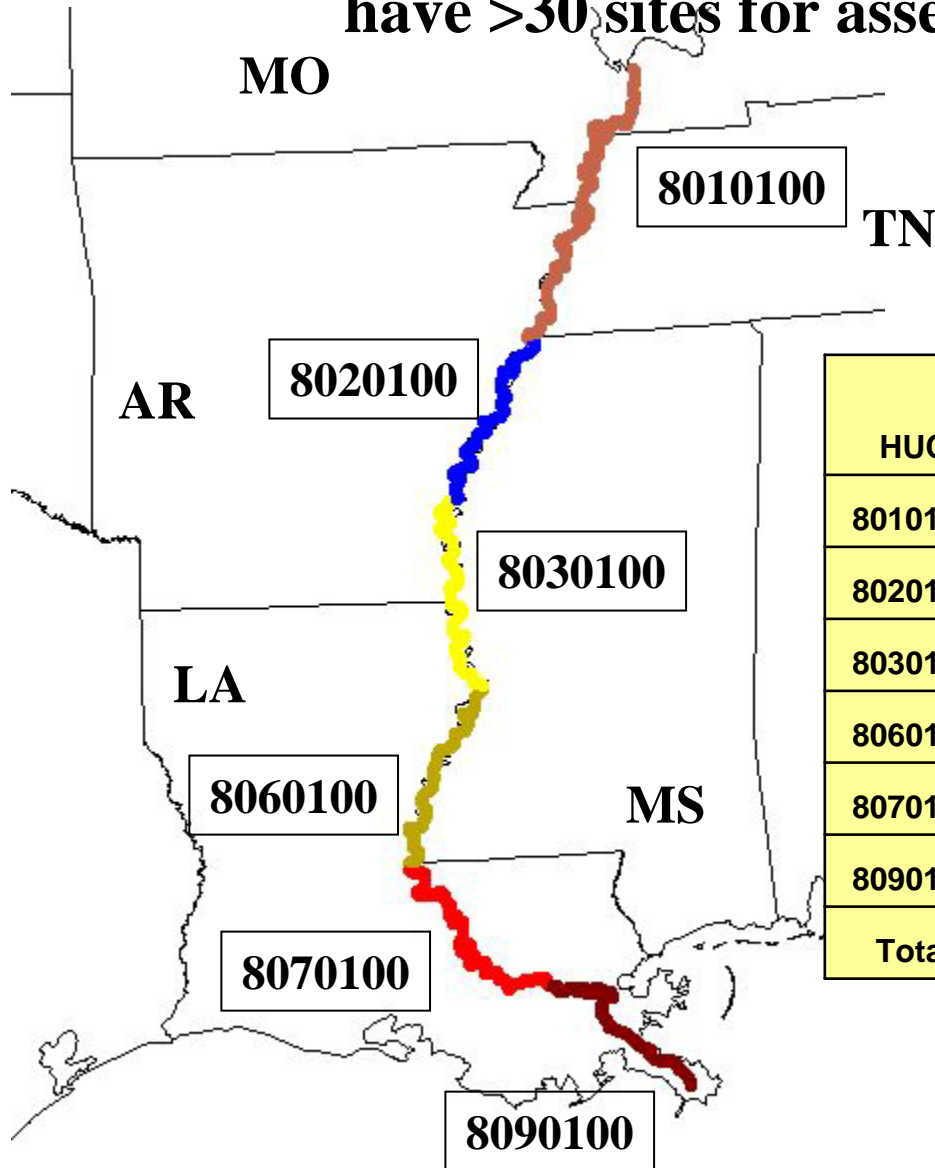
# Example: Distribute sites by interstate sections & year



Section	Length (km)	% total length	2007	2008	2009	# sites
KY-MO	100	7%	4	7	7	18
TN-MO	100	7%	4	7	7	18
TN-AR	182	11%	6	12	12	30
MS-AR	335	22%	11	22	22	55
MS-LA	323	21%	11	22	22	55
LA-LA	486	32%	16	32	32	80
<b>Total</b>	<b>1526</b>	<b>100%</b>	<b>50</b>	<b>100</b>	<b>100</b>	<b>256</b>
<b>This scheme yields:</b>						
		<b>State</b>	<b># sites</b>			
		MO	36			
		KY	18			
		TN	48			
		AR	85			
		MS	110			
		LA	135			

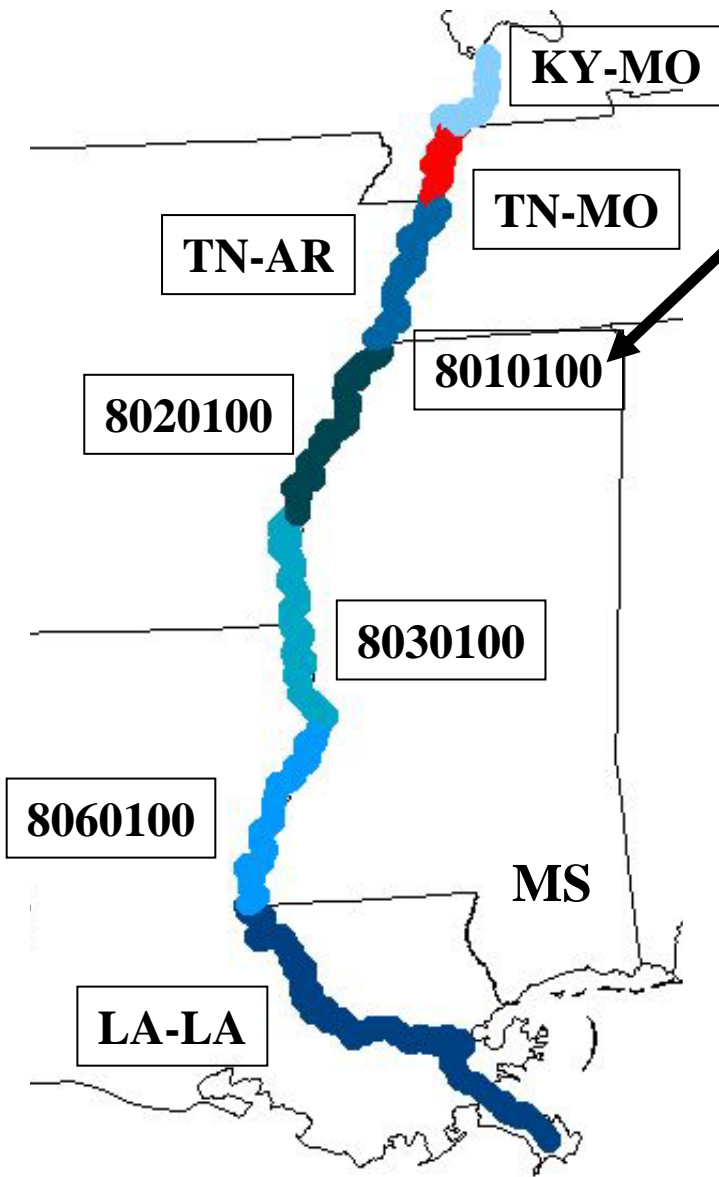
# Example: Distribute sites by HUC & year

Sites distributed proportionally to HUC length. All HUCs would have >30 sites for assessments after 3 years.



HUC	Length (km)	% length	2007	2008	2009	# sites
8010100	388	25%	13	26	26	65
8020100	206	13%	7	14	14	35
8030100	235	15%	8	16	16	40
8060100	214	14%	8	15	15	38
8070100	277	18%	10	19	19	48
8090100	206	13%	7	14	14	35
Total	1526	100%	50	100	100	261

# Example: Distribute sites by sections & HUCs in Mississippi (approximates TMDL units) & year.



Note that only 6 km of HUC 801000 is in Mississippi.

Section & HUC	Length (km)	% length	2007	2008	2009	Actual sites
8010100	6	0.4%	1	1	1	3
8020100	206	13%	7	14	14	35
8030100	235	15%	8	16	16	40
8060100	212	14%	7	14	14	35
KY_MO	100	6%	4	7	7	18
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TN_AR	182	12%	6	12	12	30
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<b>Total</b>	<b>1526</b>	<b>100%</b>	<b>50</b>	<b>100</b>	<b>100</b>	<b>259</b>
<b>State</b>	<b># sites (approx)</b>					
MO	36					
KY	18					
TN	48					
AR	68					
MS	113					
LA	135					

**EMAP-GRE Cooperative Agreements**  
**BIOASSESSMENT RESEARCH OF GREAT RIVER ECOSYSTEMS**  
**2006 Solicitation of Proposals**

• General Information

- Posted at: [https://apply.grants.gov/forms\\_apps\\_idx.html](https://apply.grants.gov/forms_apps_idx.html) as EPA-ORD-06-0416
- Solicitation is exempt from competition. Proposals will be peer-reviewed.
- Posted Date: April 15, 2006
- Due Date: August 4, 2006
- Anticipated Number of Awards: Up to 8
- Anticipated Total Program Funding: \$ 6,000,000.00
- Award Ceiling: \$ 500,000 (Year One); with up to \$500,000 per year
- Award Floor: \$ 150,000 (Year One)
- No required match or cost-sharing required.
- Only state and tribal agencies, or interstate commissions with CWA responsibilities for the Mississippi, Ohio, and/or Missouri Rivers are eligible to apply. Emphasis on Lower Mississippi River states. Proposals from multi-state consortia are encouraged.
- Mississippi, Ohio, and Missouri Rivers are primary targets. Work on major tributaries will be considered.

**EMAP-GRE Cooperative Agreements**  
**BIOASSESSMENT RESEARCH OF GREAT RIVER ECOSYSTEMS**  
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- Objectives
  - Assess ecological conditions in river(s) according to EMAP-GRE approach.
  - Develop / improve river bioassessment methods.
  - Incorporate approach into state/river assessment programs.
  
- Threshold Criteria (Proposals must:)
  - Use, to the extent possible, existing EMAP-GRE methods, biological indicators, and probability-based sampling designs.
  - Include field sampling and data analysis.
  - Promote the incorporation of probability-based sampling designs and bioassessment methods into river monitoring plans and CWA reports.
  - Characterize and develop reference conditions and biological & WQ criteria with which to assess condition.
  - Include collaborations with ORD. Should include intra- and inter-state and Regional collaborations.

# Design considerations for the Lower Mississippi River

## Discussion Agenda

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