

Midwest Stream-Quality Assessment



A Collaboration Between the:

USGS: National Water Quality Assessment (*NAWQA*) and
Columbia Environmental Research Center (*CERC*),

USEPA: National Rivers and Streams Assessment (*NRSA*)

Programs

Jeff Frey, MSQA Coordinator

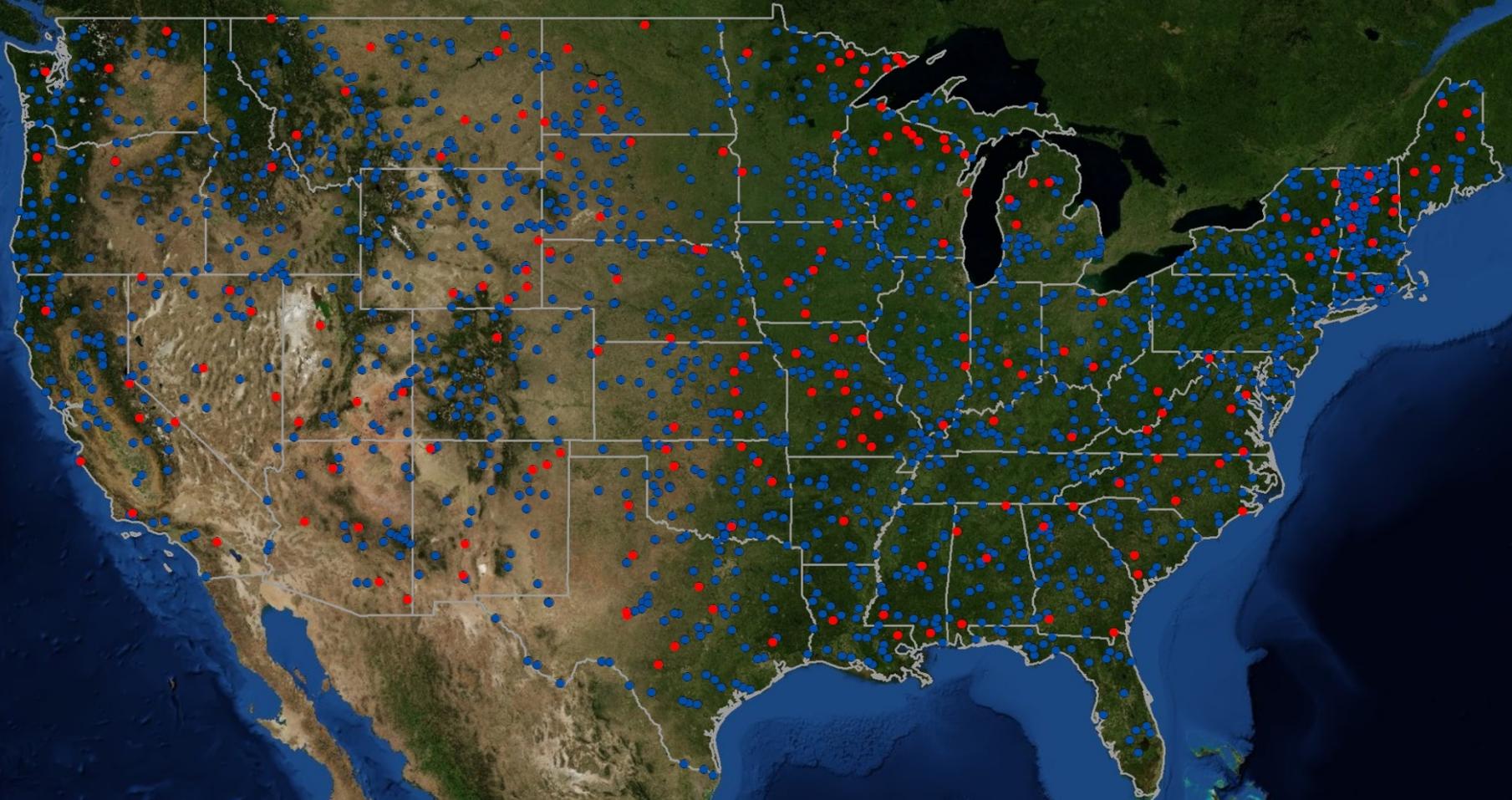
Ellen Tarquinio, NRSA Coordinator

NRSA/MSQA study (2013-14)

Goal: Evaluate multiple stressors on biological communities in the Temperate Plains (Cornbelt)

- **National Rivers and Streams Assessment (NRSA):**
 - Large sample size
 - Random
 - One chemical sample
- **Midwest Stream Quality Assessment (MSQA):**
 - Smaller sample size
 - Targeted, maximize gradient
 - More intensive stressor analysis

Design and Reference Sites for the 2013-2014 National Rivers & Streams Assessment



Legend

- NRSA 2013-2014 Base Sites
- NRSA 2013-2014 Reference Sites

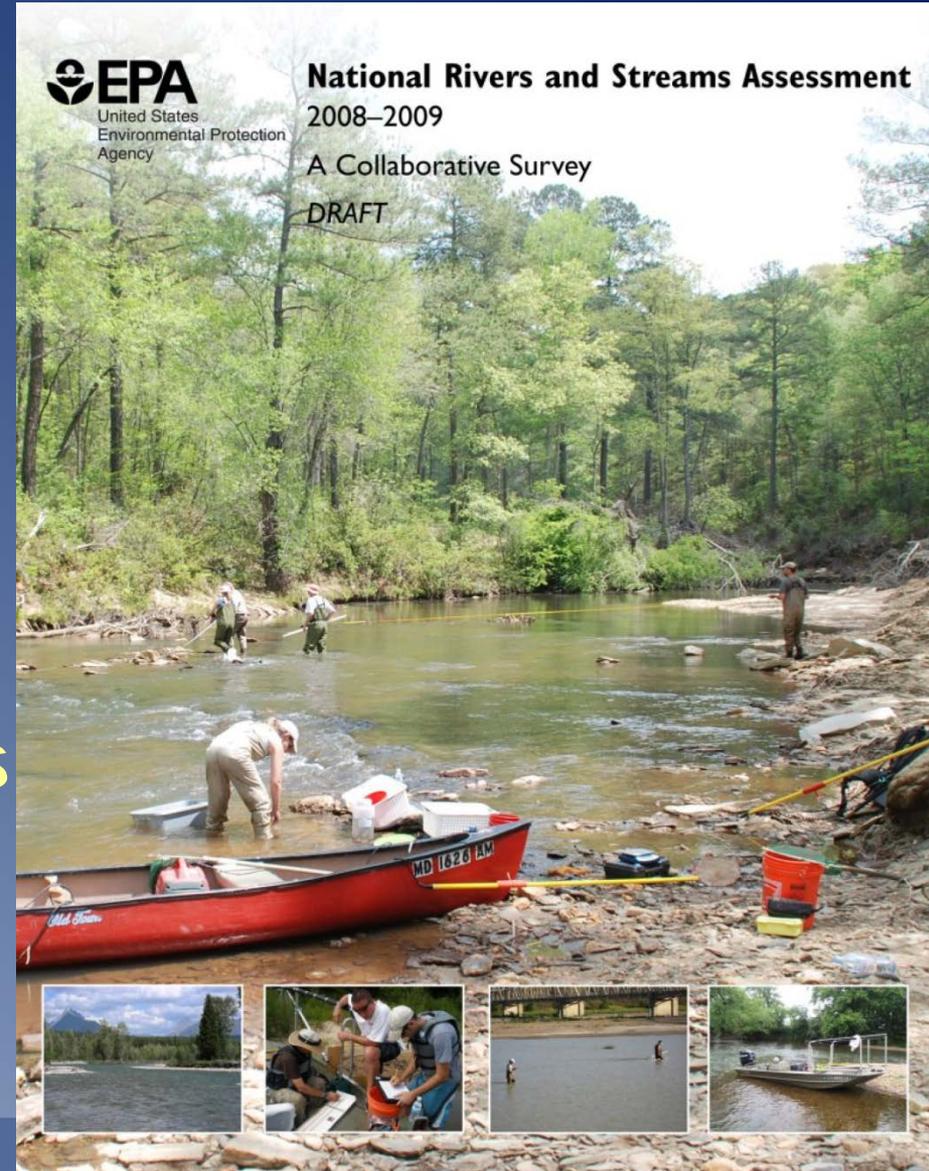
0 200 400 800 1,200 1,600
Kilometers

Source: Esri, DigitalGlobe, GeoEye, I-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community

NRSA Outcomes

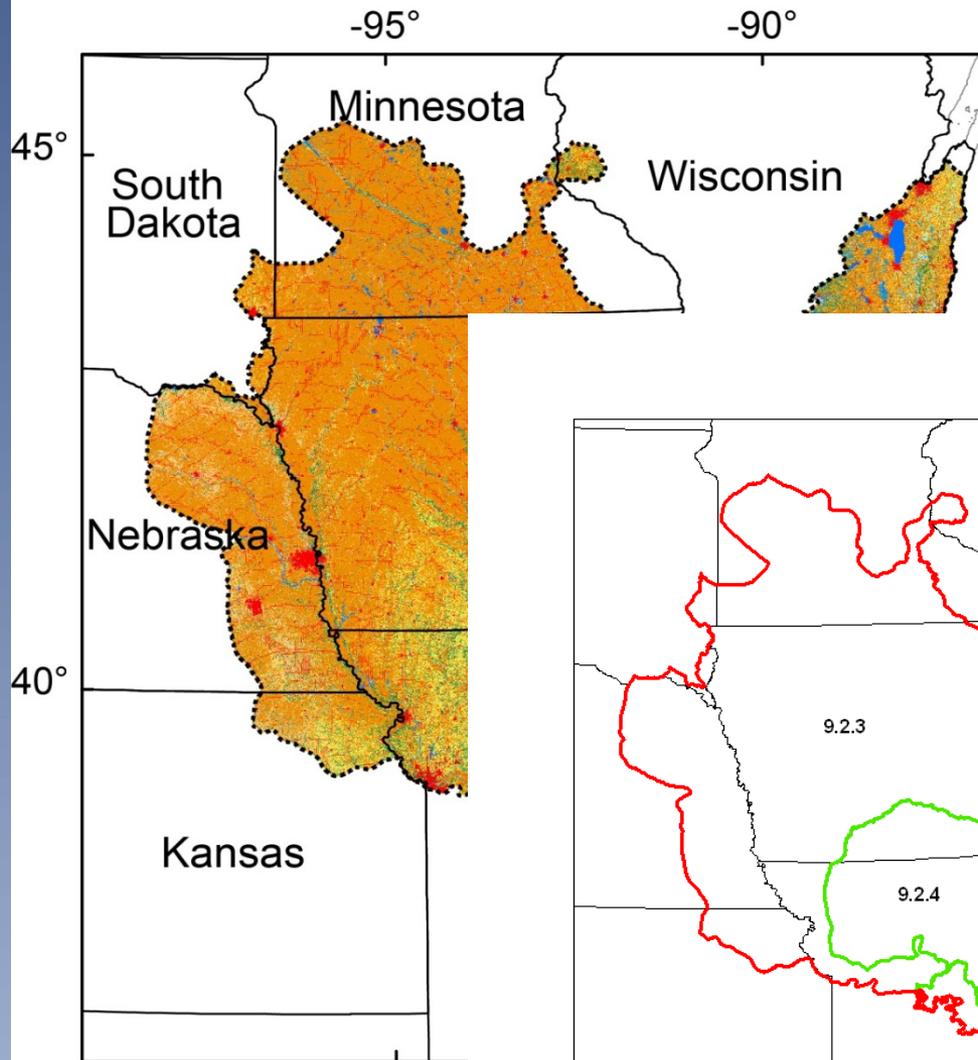
Publication: National assessment of the Nations waters

- Once every 5 years
- What is the condition of our streams?
- What are the major stressors impacting our streams?

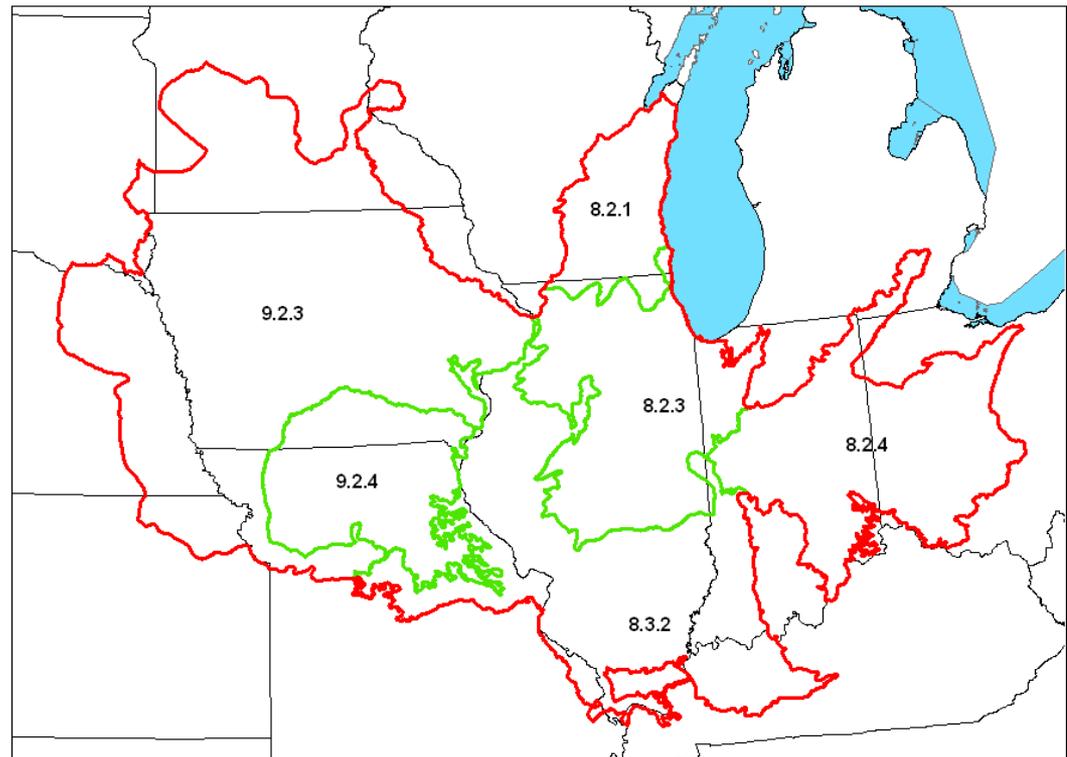


EXPLANATION

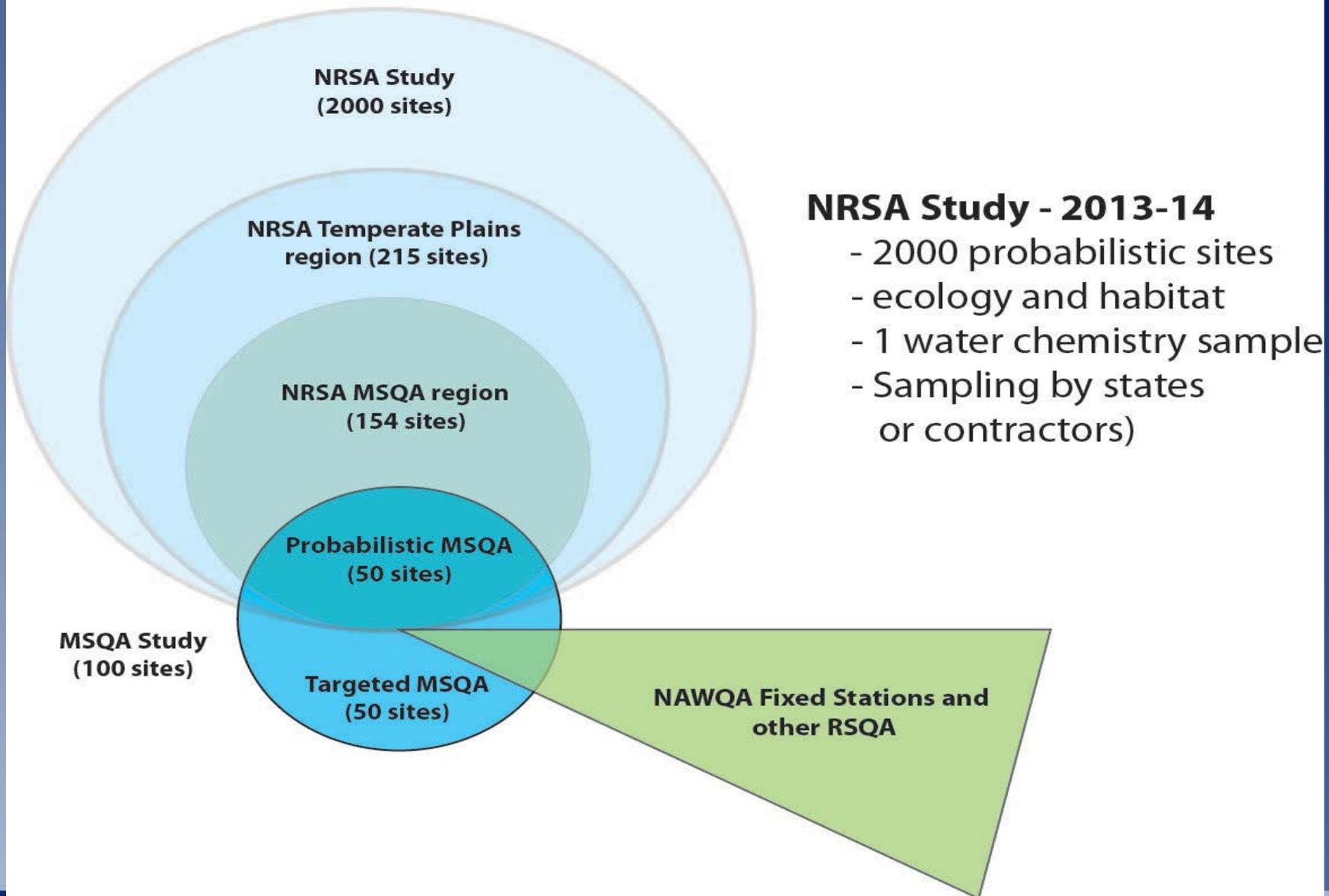
- | | | | |
|---|-------------|---|------------------|
|  | Urban |  | Grassland |
|  | Forest |  | Pasture/hay |
|  | Open water |  | Cultivated crops |
|  | Barren land |  | Woody wetlands |



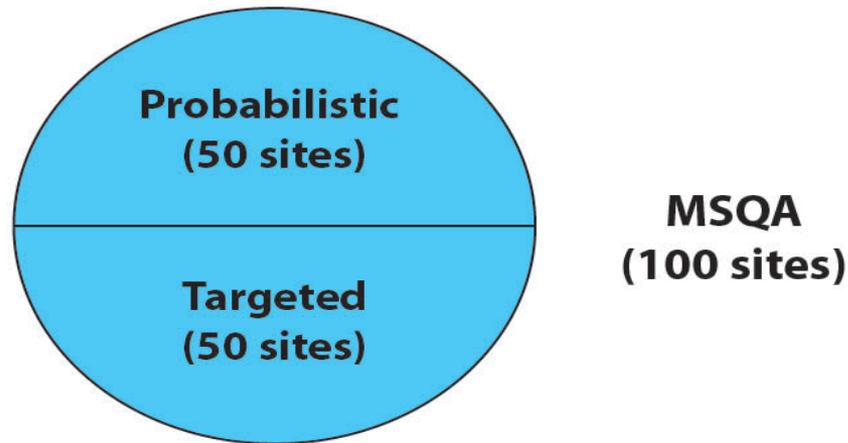
Base from U.S. Geological Survey digit
Land cover from Multi-Resolution Land
Cover Dataset (MRLCD) using the
North American Datum of 1983 (NAD 83)



Overview of the NRSA and MSQA studies



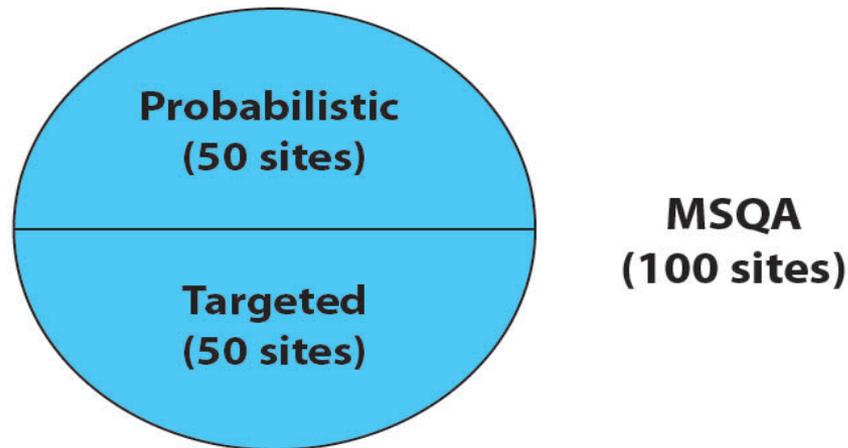
Overview of MSQA study - 2013



Types of Targeted sites in the MSQA (50 sites)

- Urban (12 sites)
- Reference (21 sites)
- Other – (17 sites)
 - NAWQA Trend sites (3 sites)
 - Long-term, on-going sites (14 sites)
 - MRBI, NSQI, state trend sites, RSQA

Overview of MSQA study - 2013



Types of sampling sites in the MSQA

- Typical – all 100 sites
 - NRSA Mercury sites – 71 sites
 - Intensive – 27 sites
 - Pankow sites – 7-10 sites

Typical Sampling Sites (100 sites)

- 12 samples (May through July)
- **EWI samples from teflon churn:** pesticides (SH2437), nutrients, chloride/sulfate, suspended sediment, **immunoassay:** estradiol, glyphosate, **monthly:** seston CHLa
- **Grab samples**
 - DOC
- **Passive Samplers (CERC)**
 - install:** late June,
 - remove:** with the last chemistry sample
 - Polar Chemical Integrator Samplers (POCIS) – pesticides
 - Semi-Permeable Membrane Device (SPMD) – PAH's

Typical Sampling Sites (100 sites) cont.

- **Bed sediment** – (July 22 through August 9)
 - collected during ecological sampling
 - 1 time per site
 - current use pesticides, major and trace elements
- **Ecological sampling** – (July 22 through August 9)
 - done by NRSA crews
 - done in a single day
 - biological communities
 - algae
 - invertebrates
 - fish
 - habitat

Typical Sampling Sites (100 sites) cont.

- Streamflow/ water levels (34 gages/ 66 ungaged)
 - Tape down from benchmark
 - Transducers
 - Discharge at least 4 times, range of flows

- Water temperature

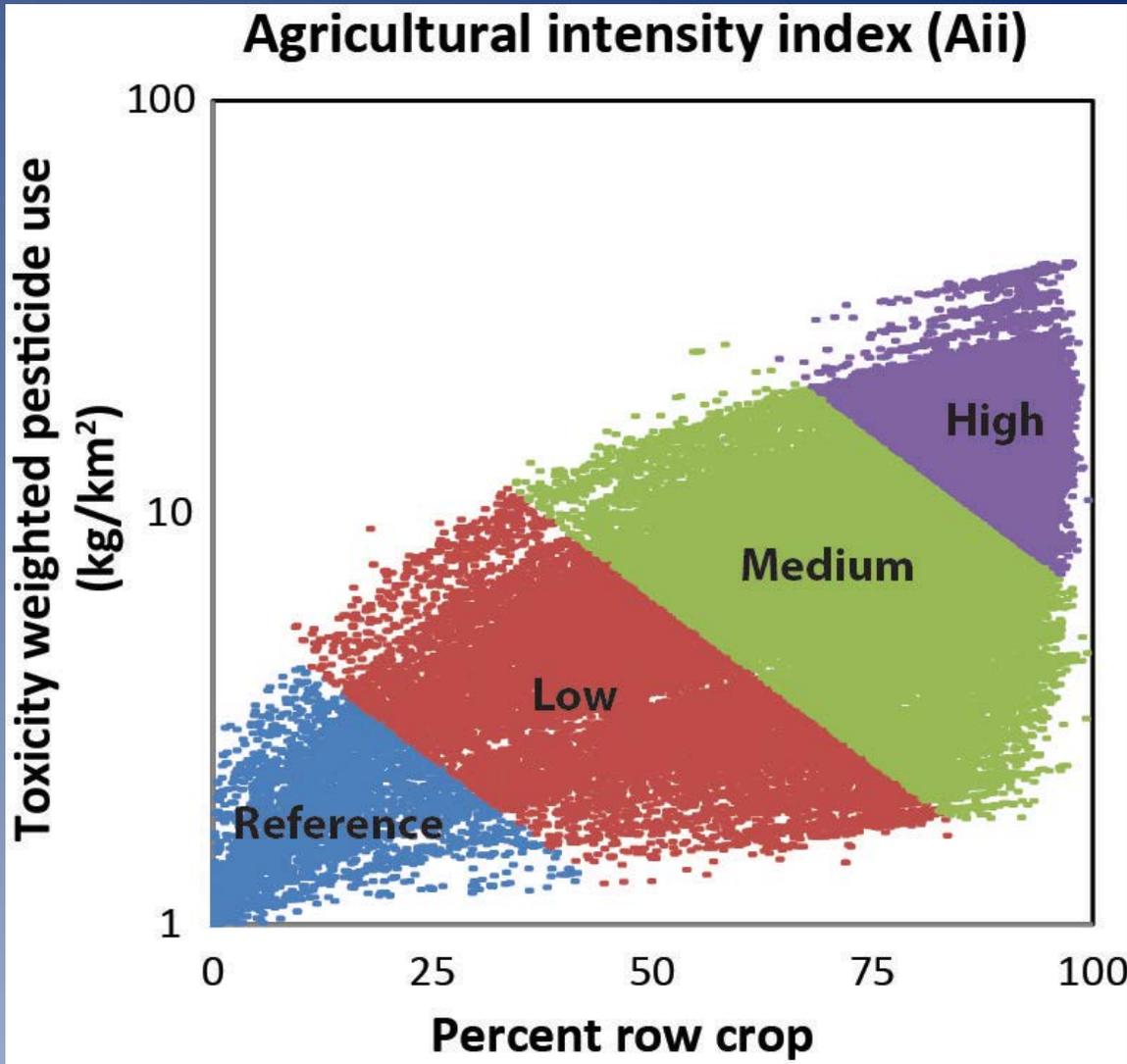
- Hobotemps at 34 gaged sites



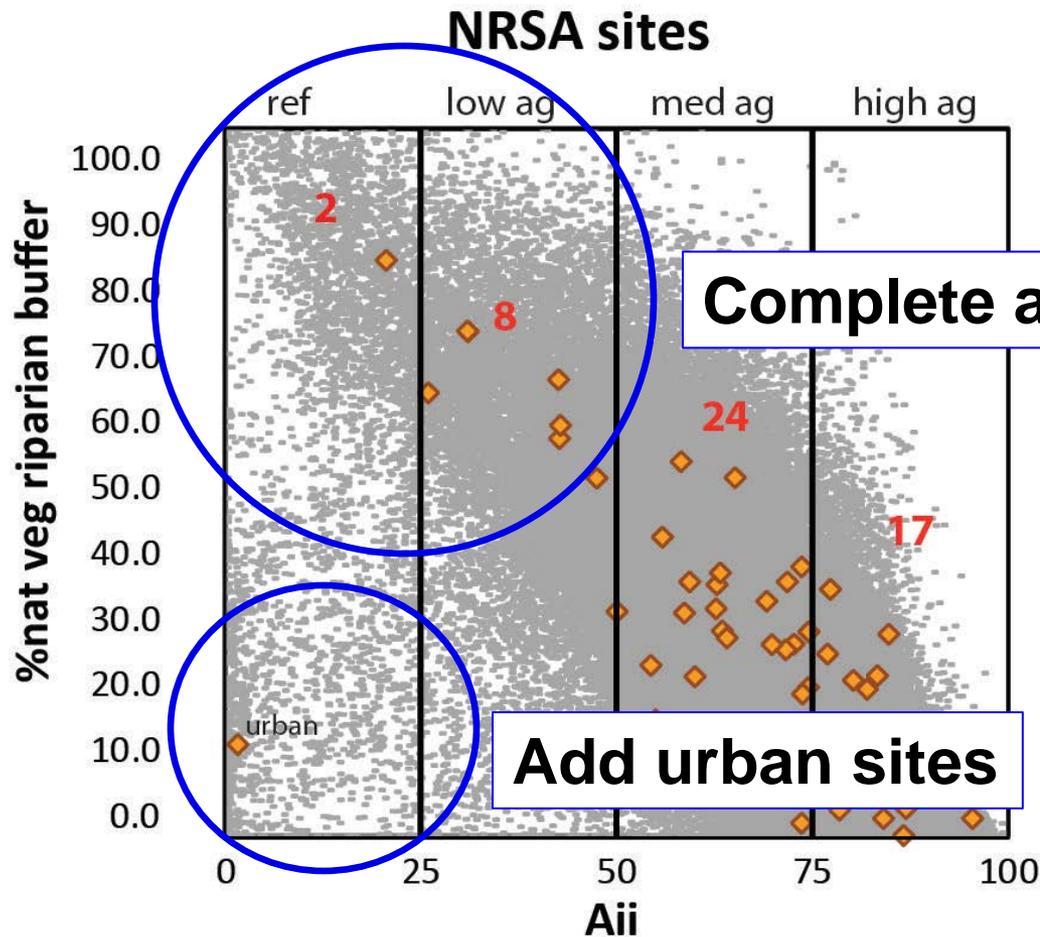
Intensive Sampling Sites (27 sites)

- Reason for this component:
 - Evaluate the occurrence of additional stressors in water and bed sediments
- Additional Sampling:
 - Done at high ag (12), urban (12), and reference (3) sites
 - **Water:** From teflon churn (6 total)
 - hormones (whole)
 - glyphosate (KS Org Lab)
 - **Sediment:** Additional analyses – original sample
 - Hormones (SH6434)
 - Halogenated compounds (LC8093)
 - PAHs, other SVOCs (SH5506)

Agricultural Intensity Gradient

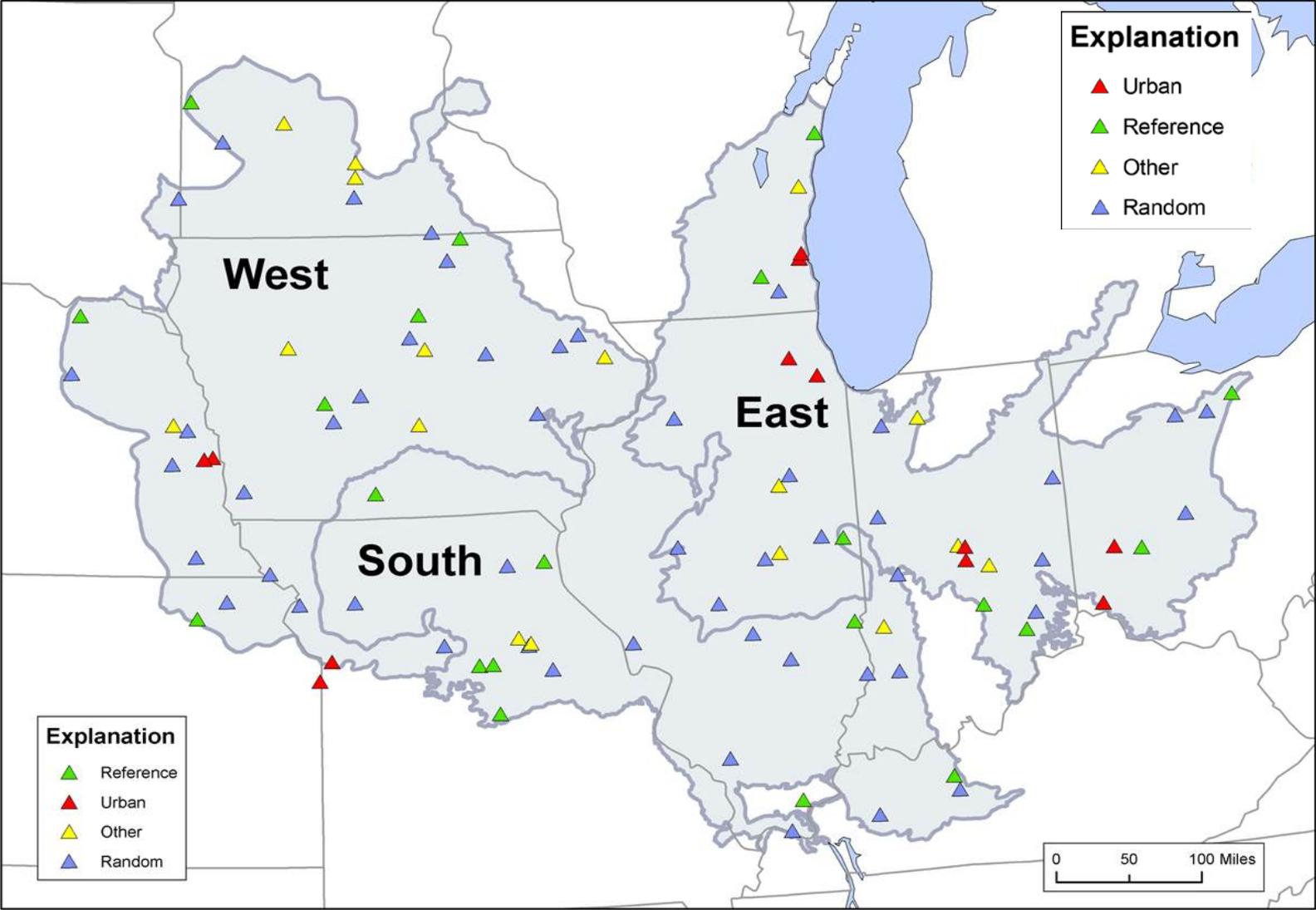


NRSA sites vs gradient



orange symbols are first 51 NRSA sites considered for sampling;
numbers are NRSA sites in each ag bin

MSQA Sampling Sites as of 4/22/13



MSQA Sites by State

<u>Region V</u>	<u>Total (Ran, Int)</u>	<u>Region VII</u>	<u>Total (Ran,Int)</u>
• Illinois:	19 (12, 2)	• Iowa:	16 (9,2)
• Indiana:	15 (7, 4)	• Kansas:	3 (1,1)
• Michigan:	(0)	• Missouri:	14 (7,4)
• Minnesota:	8 (3, 2)	• Nebraska:	8 (4,3)
• Ohio:	7 (3,3)	<u>Other Regions</u>	
• Wisconsin:	6 (2, 4)	• Kentucky:	3 (2,0)
		• South Dakota:	1 (1,0)

-
- Sites limited to 16 per state
 - 7-8 sites per crew

Urban Sites (12-14):
Chicago, Cincinnati/Dayton,
Indianapolis, Kansas City,
Milwaukee, Omaha

MSQA/NRSA Timeline

All 100 sites																
water tox on every second visit																
Holiday																
Date		6-May	13-May	20-May	27-May	3-Jun	10-Jun	17-Jun	24-Jun	1-Jul	8-Jul	15-Jul	22-Jul	29-Jul	5-Aug	12-Aug
Week	# of sites	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Water Chem typical	100	1	2	3	4	4	5	6	7	8	8	9	10	11	12	13
Water Chem intensive	27		1		2	2		3		4	4		5		6	
Water Chem Hg	71		1		2	2		3		4	4		5		6	
water toxicity	10		1			2		3			4		5		6	
Pankow	7	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
CHLa seston	100			1				2				3				
POCIS&SPMD	100						[Yellow bar]									
Sediment Chem	100												[Orange bar]			*
Sediment Tox	100												[Orange bar]			*
Eco Survey	100												[Red bar]			*

*only if eco not done, balance with early stops where eco done early

Intensive and Hg sites can sample either week in the combined boxes. Water tox sites need to be sampled the specific weeks.

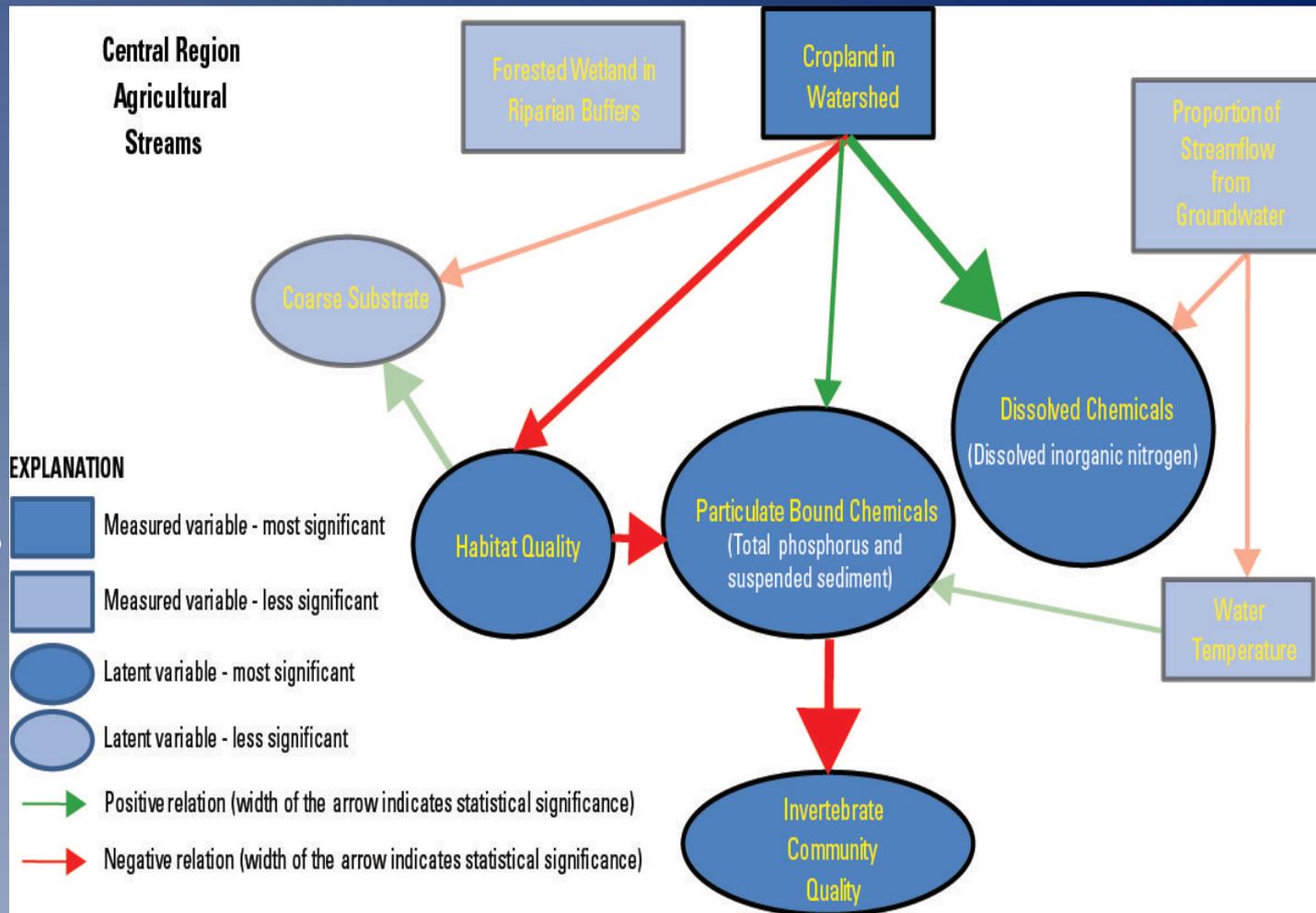


USEPA – USGS Collaboration

Potential Outcomes

• USGS Structural Equation Modeling

Shows which variables most influence instream concentrations and biological communities

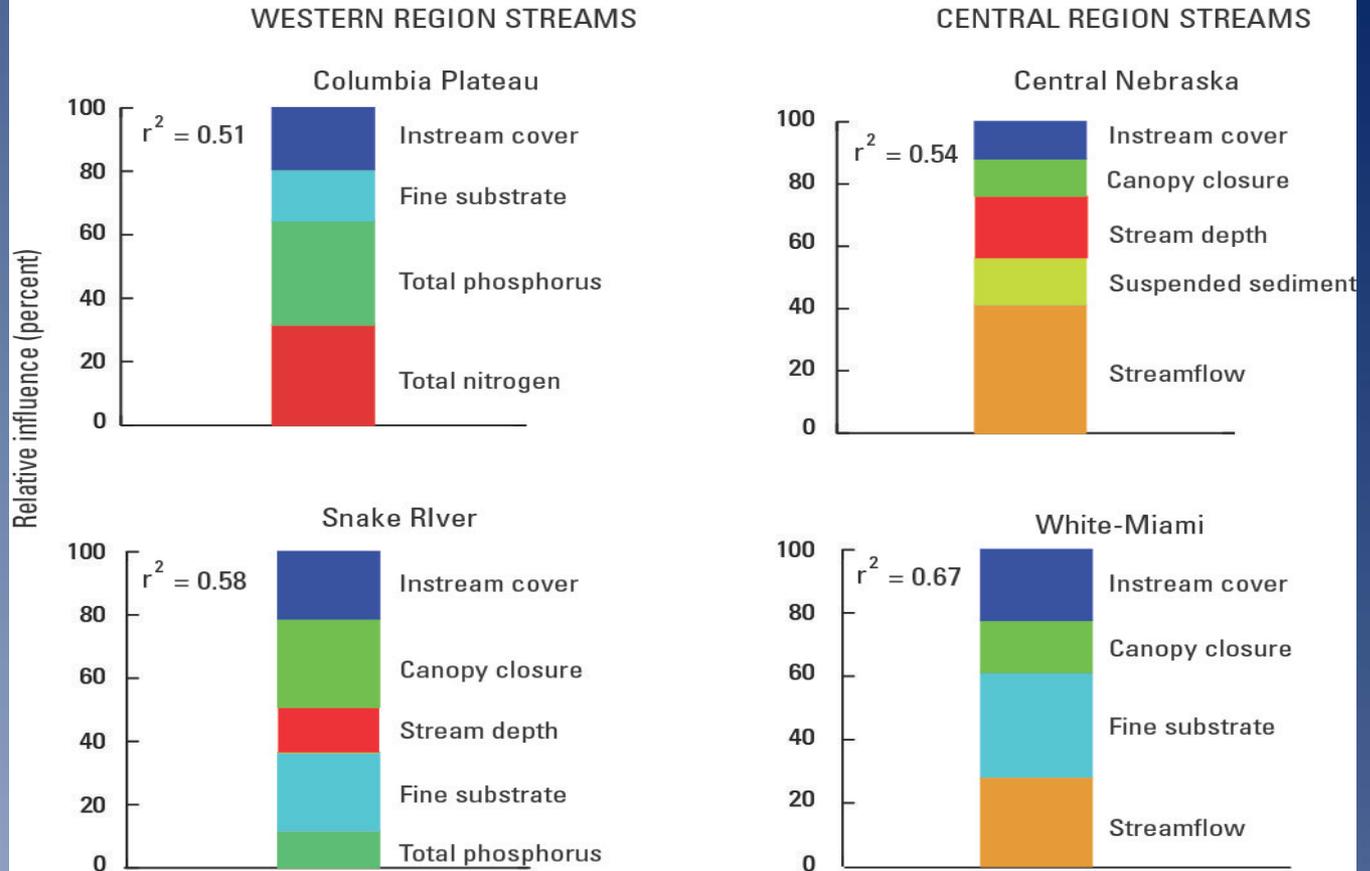


Potential Outcomes cont.

- USGS Multiple Regression Modeling

Shows which variables most influence biological communities

Relative influence of environmental factors affecting biological condition of invertebrates (O/E scores)



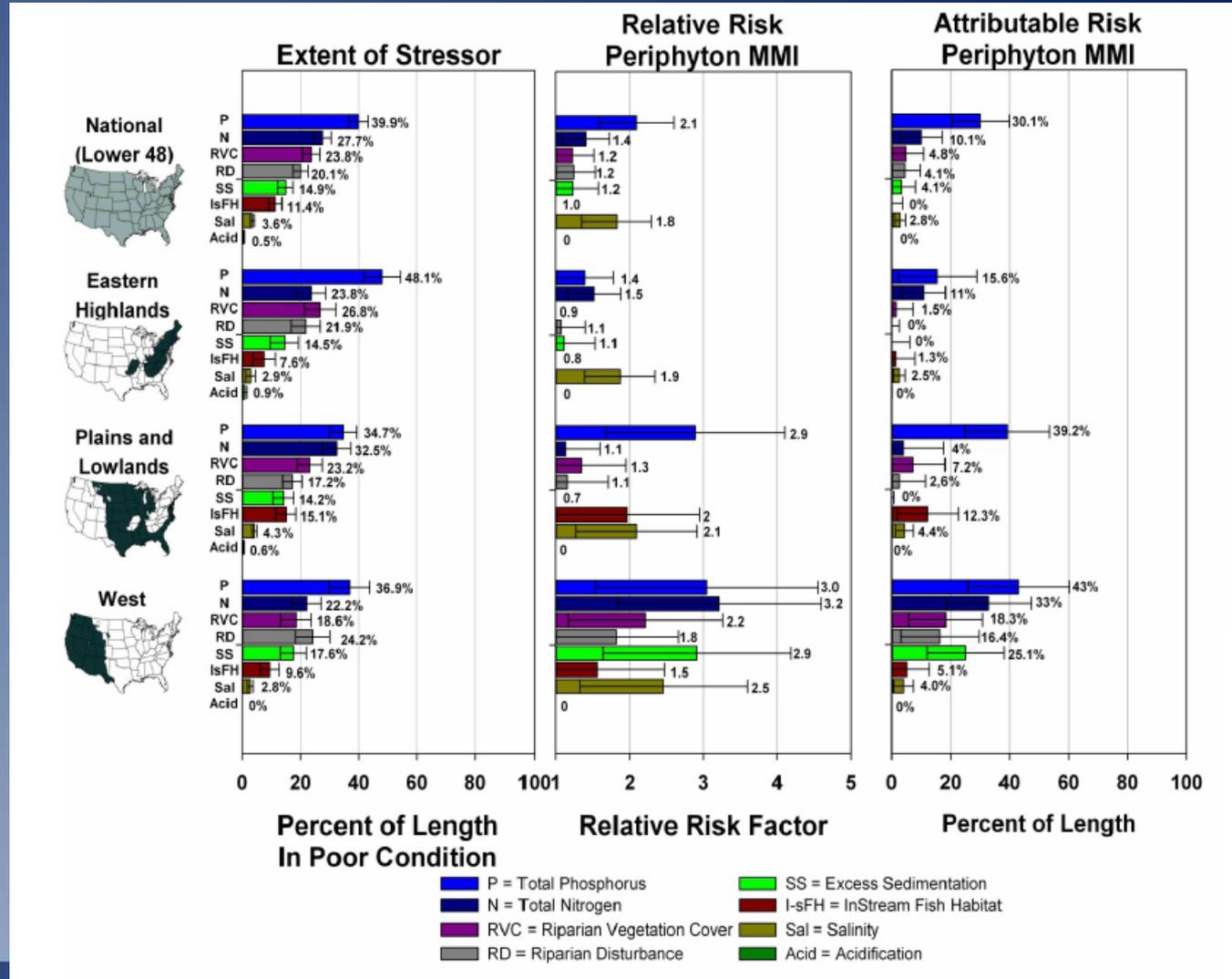
Environmental factors assessed

Nutrients, streamflow, fine substrate, suspended sediment, canopy closure, stream depth, and instream cover

Ecological modeling cont.

- USEPA Relative Risk Assessment

Shows regionally which factors are most related to poor biological condition in streams



Amphibian/Fish Study (8 sites)

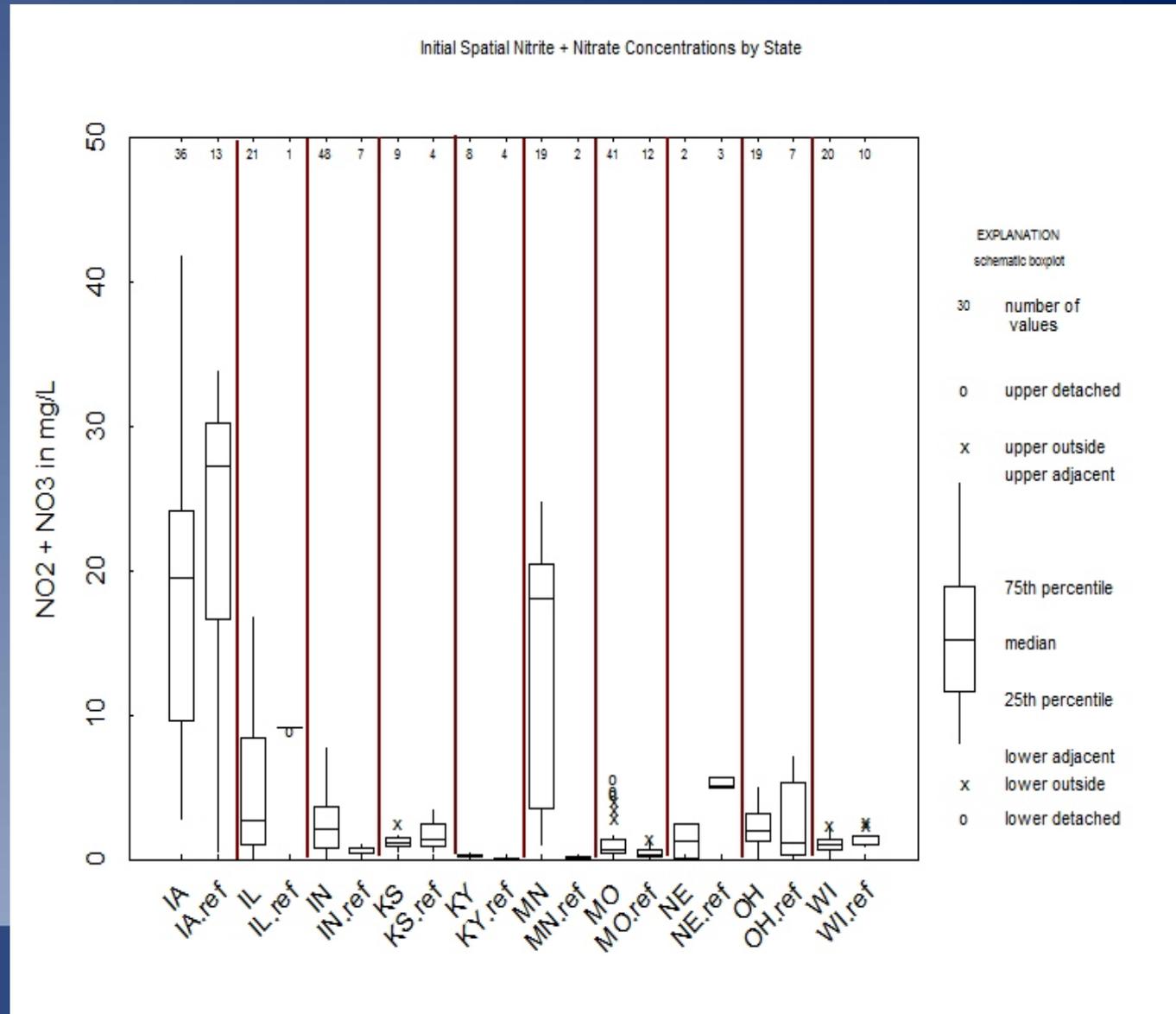
- Reason for this component:
 - Evaluate endocrine disruption from stressors in two species (leopard frog/fathead minnow) by placing caged live specimen in streams
- Additional Sampling:
 - Done at 8 sites in northern Missouri
 - All work done by CERC staff
 - Site gradient
 - reference or low ag (4)
 - high ag (4)

Pankow Sampling Sites (7-10 sites)

- Reason for this component:
 - (1) Evaluate the temporal occurrence of pesticides using a new micro- autosampler (7 sites)
 - (2) Assess water toxicity at a subset of sites (10 sites)
- Additional Sampling:
 - Done at targeted high ag (3), urban (4)
 - Pankow sites: (12 total samples)
 - daily samples (USEPA OPP)
 - weekly samples (USGS NWQL)
 - Water toxicity: 14-L whole (6 total samples) (CERC)
 - 1 L pyrethroids (CAPEST)

Initial Results...very initial

- Remarkably high concentrations in IA and MN
- Drought to flooding conditions
- Some reference sites not suitable



Information and Contacts

NAWQA – USGS

<http://water.usgs.gov/nawqa>

NRSA – USEPA

<http://water.epa.gov/type/rs1/monitoring/riverssurvey/index.cfm>

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NRSA Hg Sampling Sites (71 sites)

- Reason for this component:
 - Evaluate the occurrence of Hg in water and fish tissues
 - Relative methylation efficiency in these streams
- Additional Sampling:
 - Done at random sites (50) and reference sites (21)
 - Samples collected every other time (6 total)
 - Grab samples (whole)
 - Methyl Hg and Total Hg
 - Samples collected every other time (6 total)
 - Ecological sampling (done by NRSA)
 - **Tissue:** Tissue plug at target species (100 sites)

Nutrient processing (6 sites)

- Reason for this component:
 - Assess the ability to use continuous monitors, algal biomass, and hyporheic water samples to understand nutrient processing in streams along a nutrient gradient
- Additional Sampling (Mark Munn- lead):
 - Done at 6 sites in IA, IL, IN
 - All work done by RSQA/IWS staff – **RSQA pilot project**
 - Continuous monitoring
 - NO₃, pH, DO, SC, temp, turbidity, FDOM
 - periphyton CHLa
 - nutrient and carbon samples from hyporheic zone

Sediment and Geomorphic Structure (15 sites)

- Reason for this component:
 - Determine how sediment and the geomorphic structure of channels may impact ecosystem health
- Additional Sampling (Allen Gellis - lead):
 - Work done primarily by RSQA staff: **RSQA pilot project**
 - Source analysis of fine-grained sediment,
 - Understanding channel morphology and channel change, and
 - Analysis of sediment loads and concentrations

Data Management

- PCFF
 - Training: Week of April 11 or 12, Susan Hartley
- Field laptops/platforms
 - Transducers
 - Temperature thermistors
 - PCFF
- Continuous monitors/ nutrient processing study
(2-3 sites)

What is the NRSA?

The NRSA 2013/14 is a statistical assessment of the condition of our Nation's rivers and streams and is designed to:

- Assess the condition of the Nation's rivers and streams;
- Assess the extent and impact of major stressors;
- Evaluate changes in condition from the 2008/09 NRSA
- Help build State and Tribal capacity for monitoring and assessment and promote collaboration across jurisdictional boundaries.



NRSA Sampling Design

- **Probability-based site selection.**
- **Randomized design allows data to be applied to the larger target population.**
- **Sites were chosen from a subset of the National Hydrography Dataset (NHD) Plus.**
- **Sites are distributed among six categories and are spatially distributed across the lower 48 states and nine aggregated Omernik Level 3 ecoregions.**
 1. NRSA 2008-2009 resample 1-4th Strahler order sites.
 2. NRSA 2008-2009 resample 5th and above Strahler order sites.
 3. Small Stream- new 0-2 Strahler order sites.
 4. Large Streams- new 3-4 Strahler order sites.
 5. Major Rivers- new 5 and above order sites. Rivers identified as major rivers or additional rivers in the book: Rivers of North America.
 6. Other Rivers- new 5 and above order sites that are not considered Major Rivers.

