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The U.S. Geological Survey's National Water-Quality Programs in the Mississippi River Basin

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EMAP Symposium 2002

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NASQAN II

NAtional
Stream
Quality
Accounting
Network

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What was NASQAN I

- Begun in early 70's and continued through the mid 90's with the objective to provide nationally comparable information on water quality
- At its greatest extent funded at $5 million annually and included sampling at over 500 stations. Samples were collected from the downstream end of most ***hydrologic accounting units***: hence, the term accounting in the name.

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Was the program successful?

- Yes, data have been used in a variety of ways:
  - 1. To assess trends in water quality over time
  - 2. Used extensively by States in their 305(b) assessments
  - 3. To determine the flux of nutrients into the Gulf of Mexico and to determine sources areas for these nutrients within the Mississippi River Basin

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What happened to NASQAN I

- Program objectives could not be achieved with available funding.
- Inadequate qa/qc program
- Constituents measured did not include important chemicals, such as pesticides and trace elements
- Relation between NAWQA and NASQAN unclear

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Big Rivers

- Mississippi River (1.2 Million square miles)
- The Great Lakes/St. Lawrence (396,000)
- Rio Grande (336,000)
- Yukon (328,000)
- Columbia (258,000)
- Colorado (250,000)
- next largest river 20% less than Colorado

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NASQAN II OBJECTIVES

- Provide an ongoing characterization of concentrations and flux of chemicals and sediment in the Nation's largest rivers
- Determine source areas for these materials
- Assess the effect of human influences on the observed concentrations and flux

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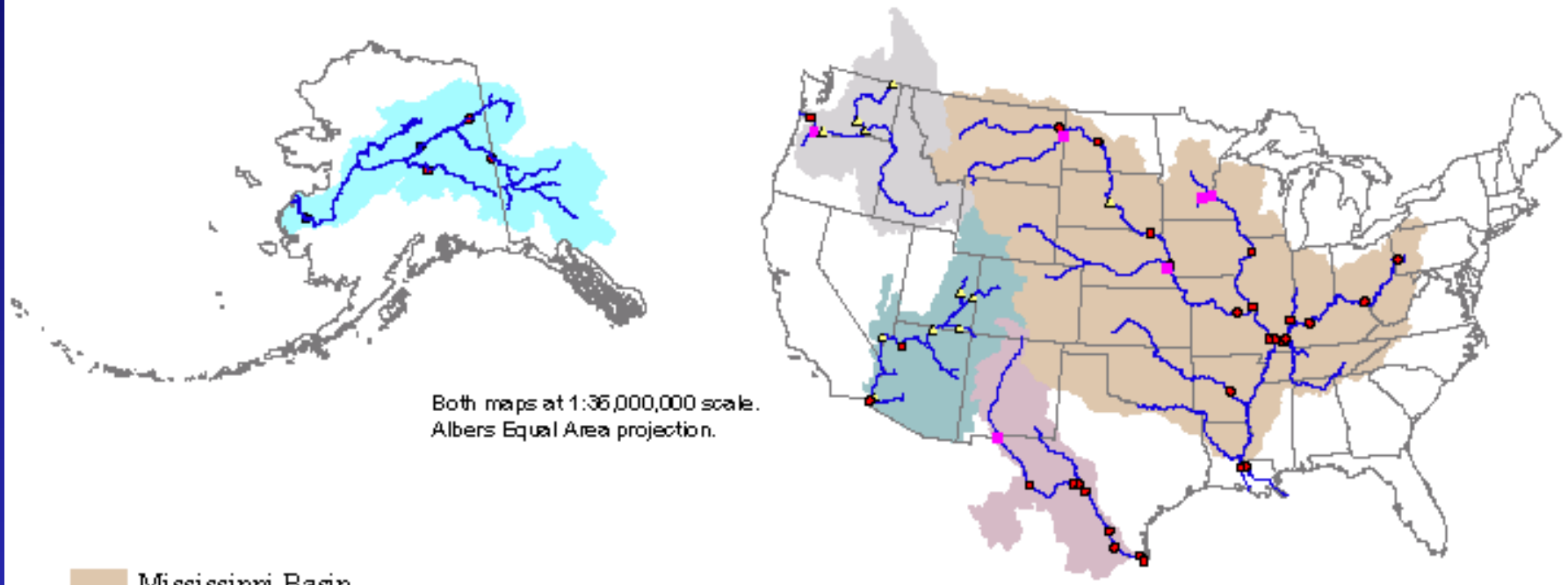
Sampling Site Selection

- Located on the main stem of the Mississippi River and some of it's major tributaries and distributaries:
  - Ohio, Missouri, Tennessee, Cumberland, Wabash, Arkansas, Atchafalaya etc…
  - Located at critical junctures in the Mississippi River --below major reservoirs on the Missouri, along the main stem where there is a large increase in flow

NASQAN Stations, Fiscal Year 2002



Both maps at 1:36,000,000 scale.
Albers Equal Area projection.

- Mississippi Basin
- Rio Grande Basin
- Colorado Basin
- Columbia Basin
- Yukon Basin
- Active NASQAN Station
- Inactive NASQAN Station
- NAWQA Integrator Station

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NASQAN Sample Collection

- Sampling frequency varies among stations, from 6 to 12 samples annually, with a possibility of more during extreme high flow events. The number of samples depends on the expected variability of water quality at the site. Since this is a flux based program, more samples are allocated during expected high flows.

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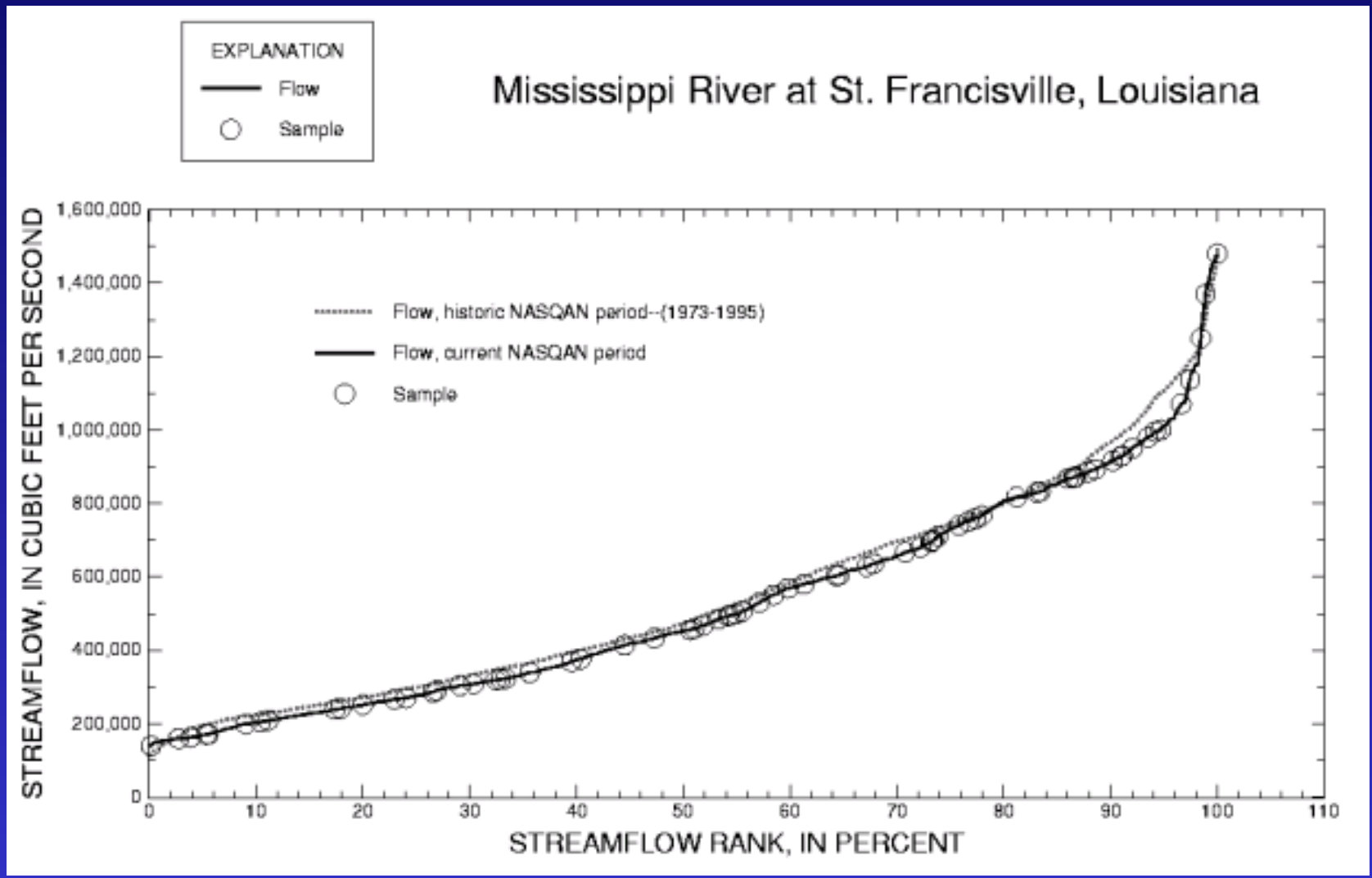

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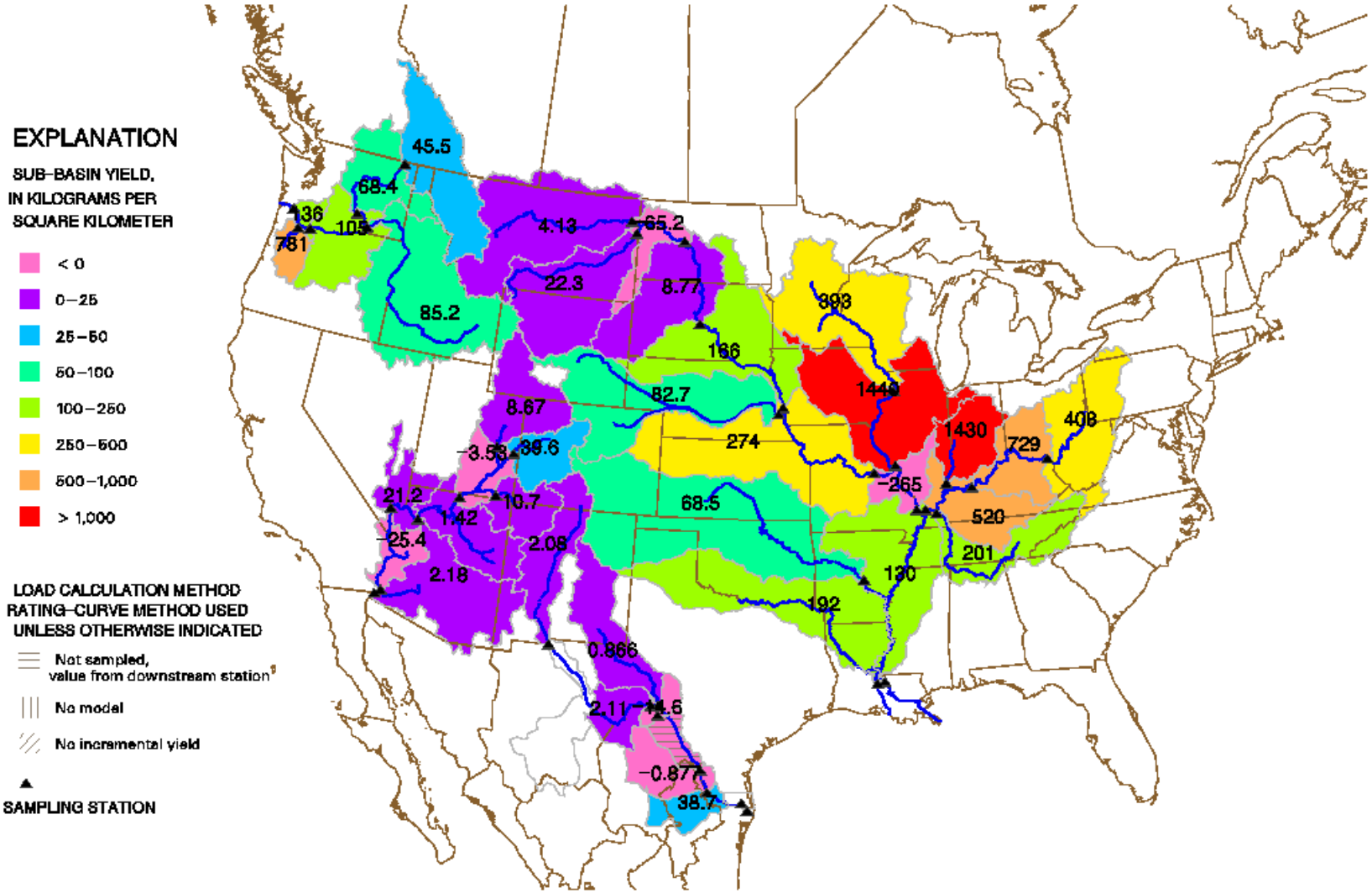
Fluxes are computed using the rating curve method

$$\hat{L}_{\mathrm{M}} = \frac{1}{T} \sum_{i=1}^{T/\Delta t} f(Q_i)$$

The rating curve equation $f(Q_i)$ has the form:

$$\ln(L) = a_o + a_1 \ln(Q) + a_2 \ln(Q)^2 + a_3 \sin(t) + a_4 \cos(t) + a_5 t$$

NASQAN SUB–BASIN MEAN ANNUAL YIELD, DEFINED INCREMENTALLY BY DIFFERENCE, OF NITRITE+NITRATE–N (00631) FOR WATER YEARS 1997–2000



The USGS NAWQA Program in the Mississippi River Basin

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POLICY QUESTIONS

- Is the quality of the Nation's streams and groundwater improving?
- Are national water-quality goals being met?
- How should resources be allocated among competing water-quality problems?
- Can regulations for selected water-quality constituents be targeted to particular geographic regions or hydrologic settings?

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NAWQA OBJECTIVES

- **STATUS -- Describe the quality of the Nation's water resources in a consistent manner**
- **TRENDS -- Assess long-term trends and changes in water quality**
- **UNDERSTANDING -- Identify, describe, and explain factors that govern water quality**

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NAWQA Implementation

High Intensity Phase – 3 Years

Low Intensity Phase – 6 Years

60 Study Units – 20 in each HIP

- Study units started in 1991:
  - Data from 1993-95
- Study units started in 1994:
  - Data from 1996-98
- Study units started in 1997:
  - Data from 1999-2001

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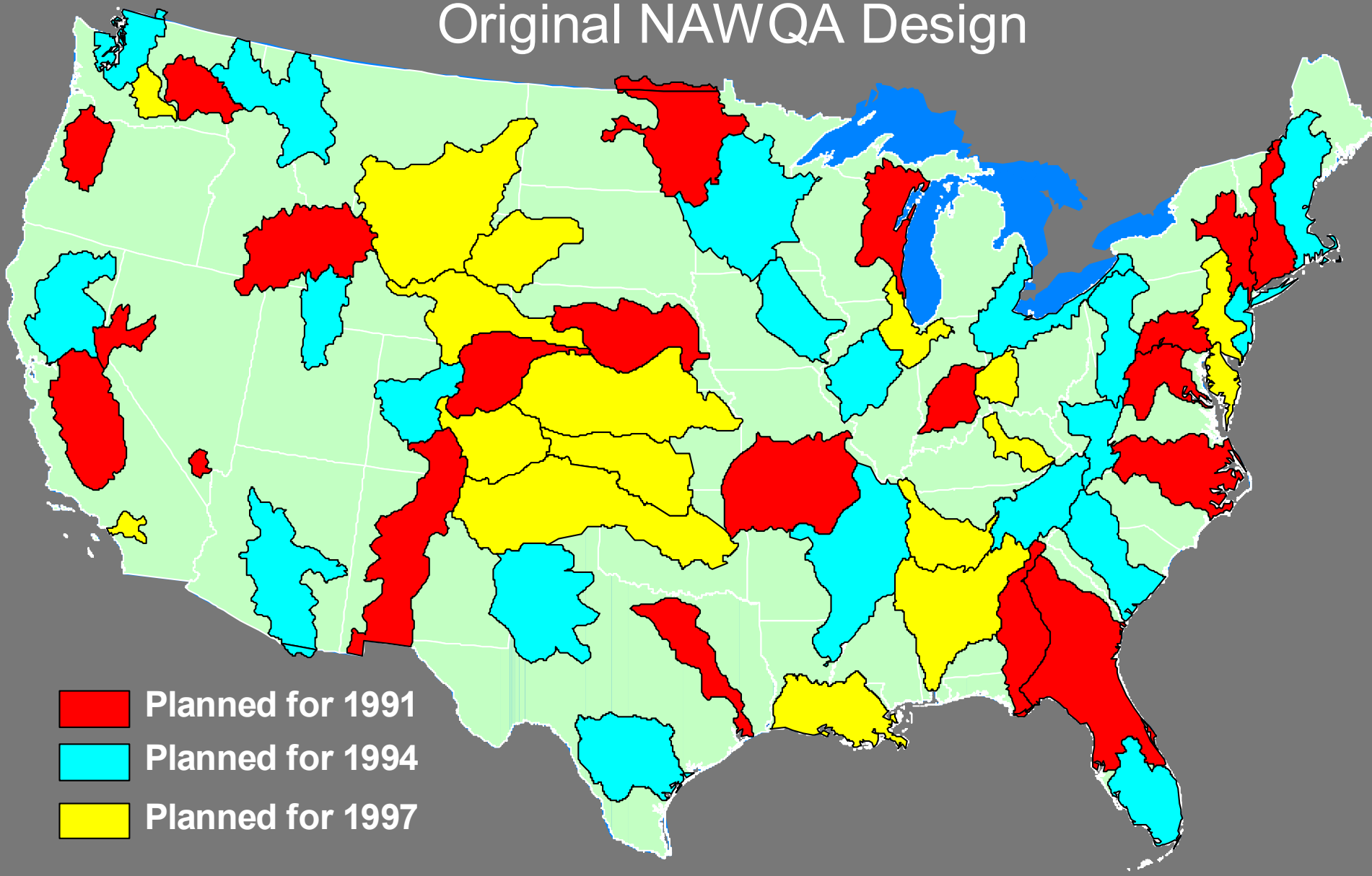
Original NAWQA Design



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Stream Sites in the NAWQA Trend Network

Indicator sites – small basins, homogeneous land use:

1. Agricultural
2. Urban
3. Reference

Integrator sites – large basins (> 1000 mi^2 and > 1000 cfs), mixed land use

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NAWQA Site Selection Criteria

Agricultural Indicator Sites

Proportional coverage of the most important agricultural settings in the Nation.

Urban Indicator Sites

1. Coverage of the largest metropolitan areas.
2. Coverage of metropolitan areas where potential growth is highest.

Reference Indicator Sites

1. Sites in the same ecoregion as agricultural and urban sites.
2. Sites downstream from unique natural areas.

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Selection Criteria for Integrator (Large River) Sites

1. Downstream from indicator sites.

2. Sites with the most historical data.

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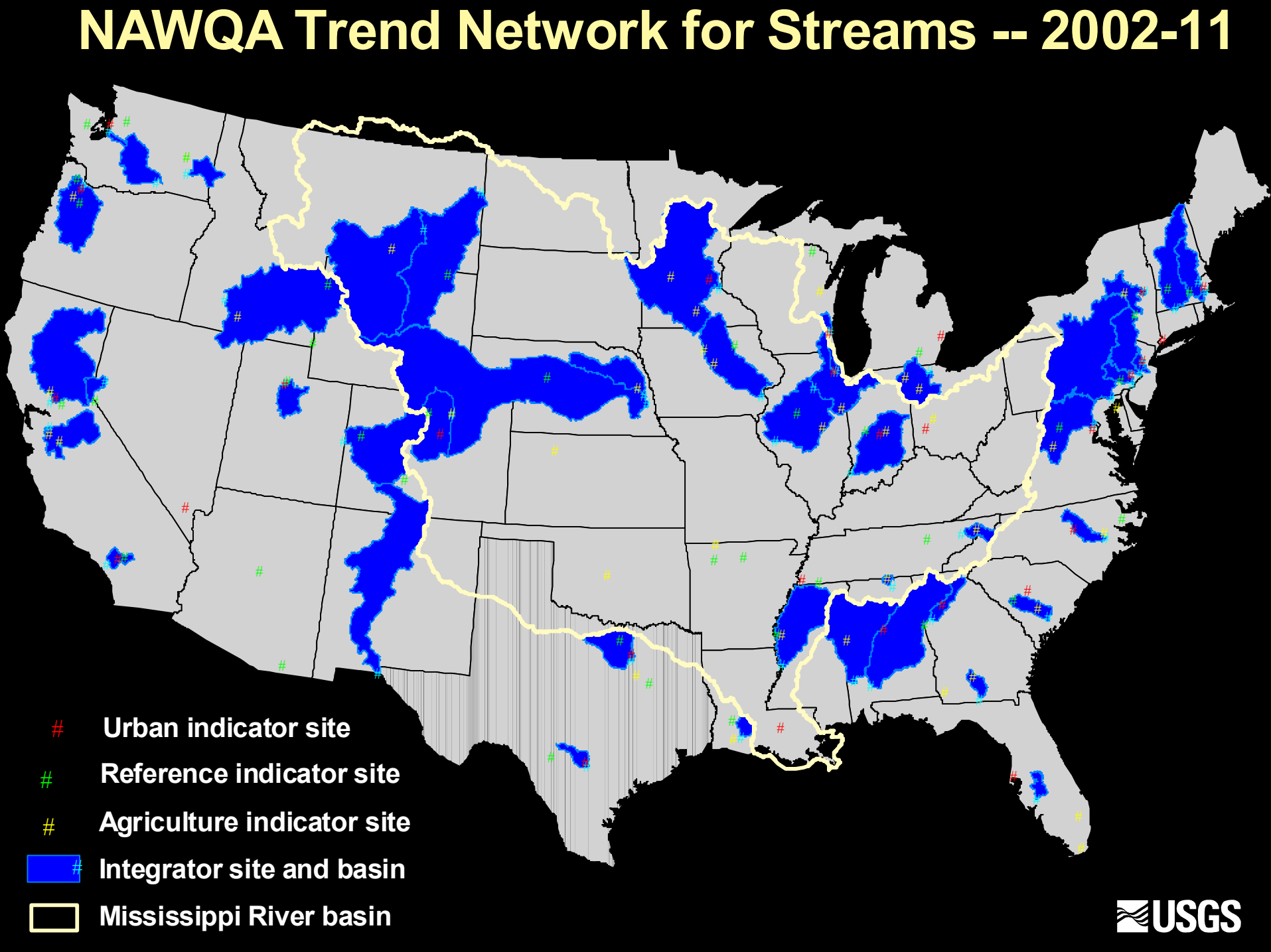
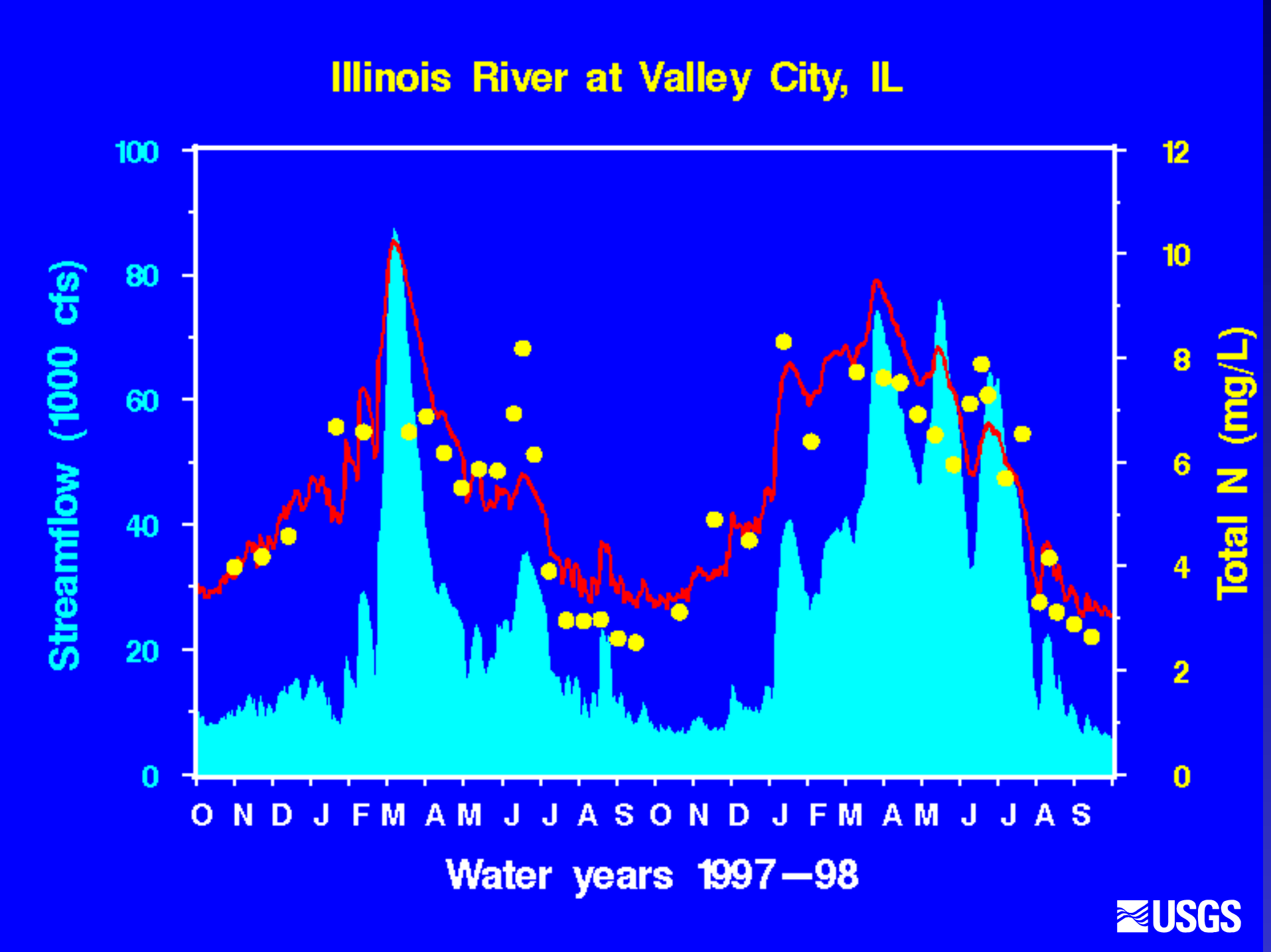
NAWQA Trend Network for Streams -- 2002-11




Illinois River at Valley City, IL
Streamflow (1000 cfs)
100
80
60
40
20
0
Total N (mg/L)
12
10
8
6
4
2
0
O N D J F M A M J J A S O N D J F M A M J J A S
Water years 1997—98
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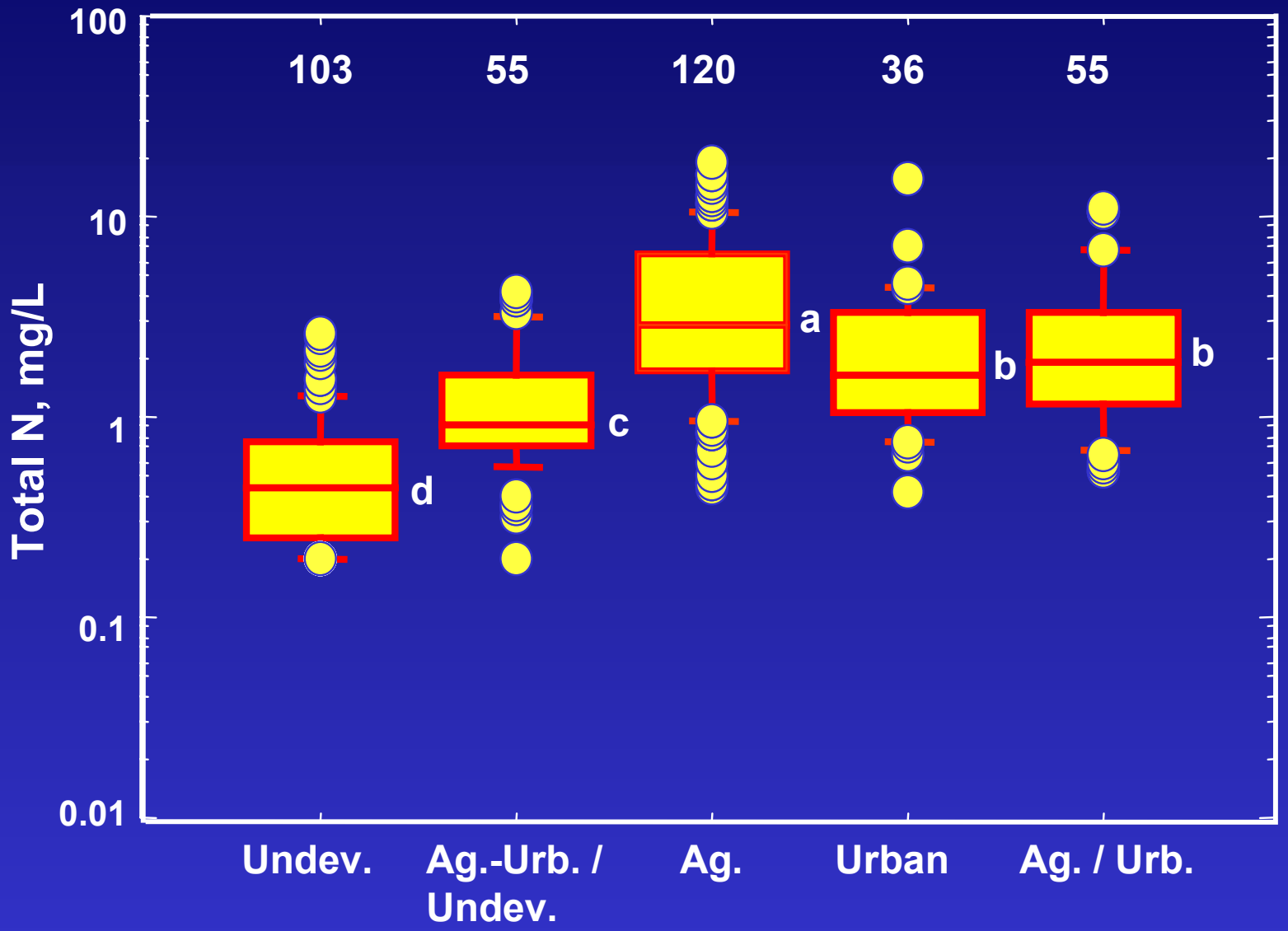
Differences in Concentration Downstream from Categorized Land Use



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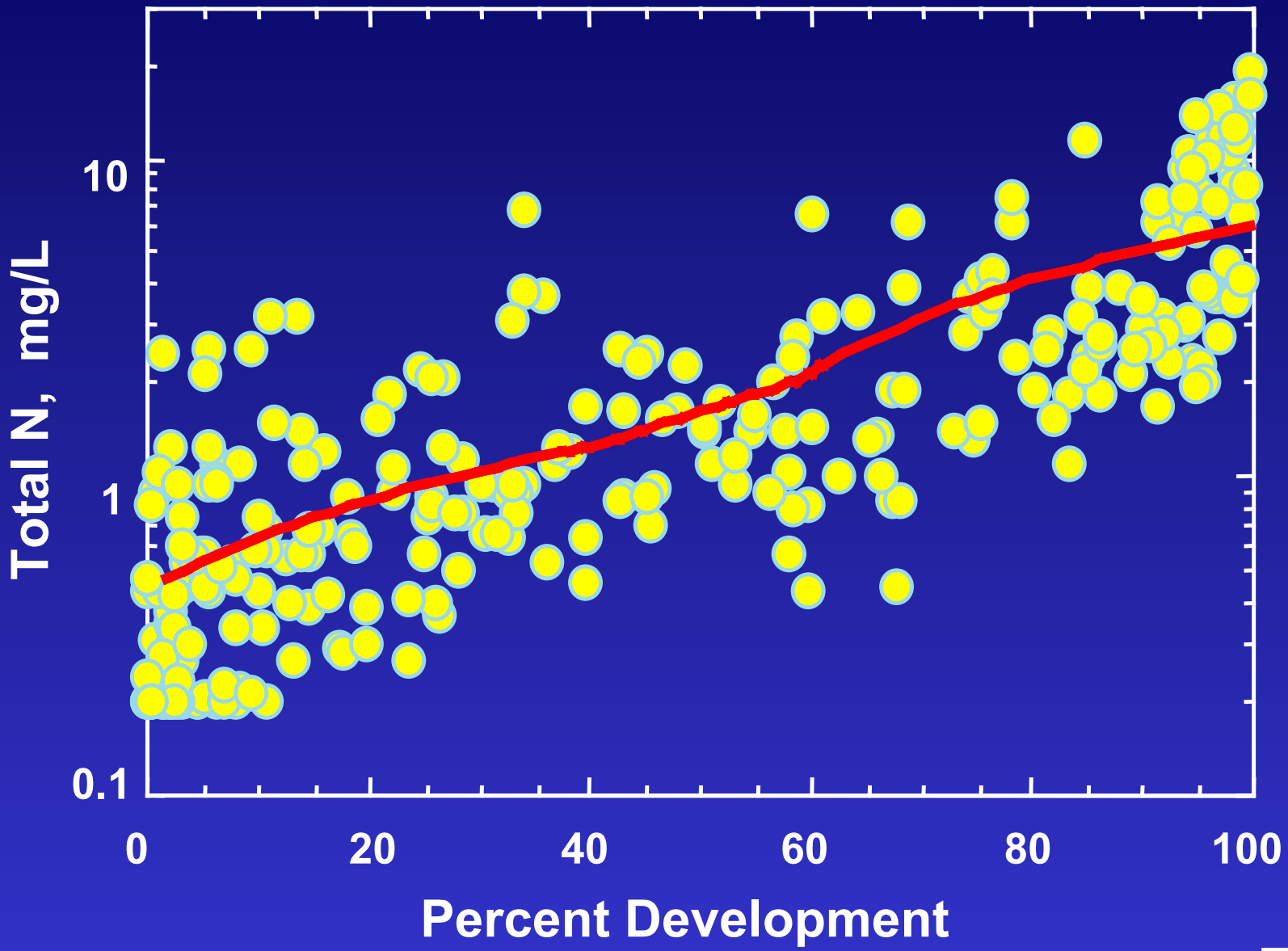
Relation of Concentration to Upstream Land Use



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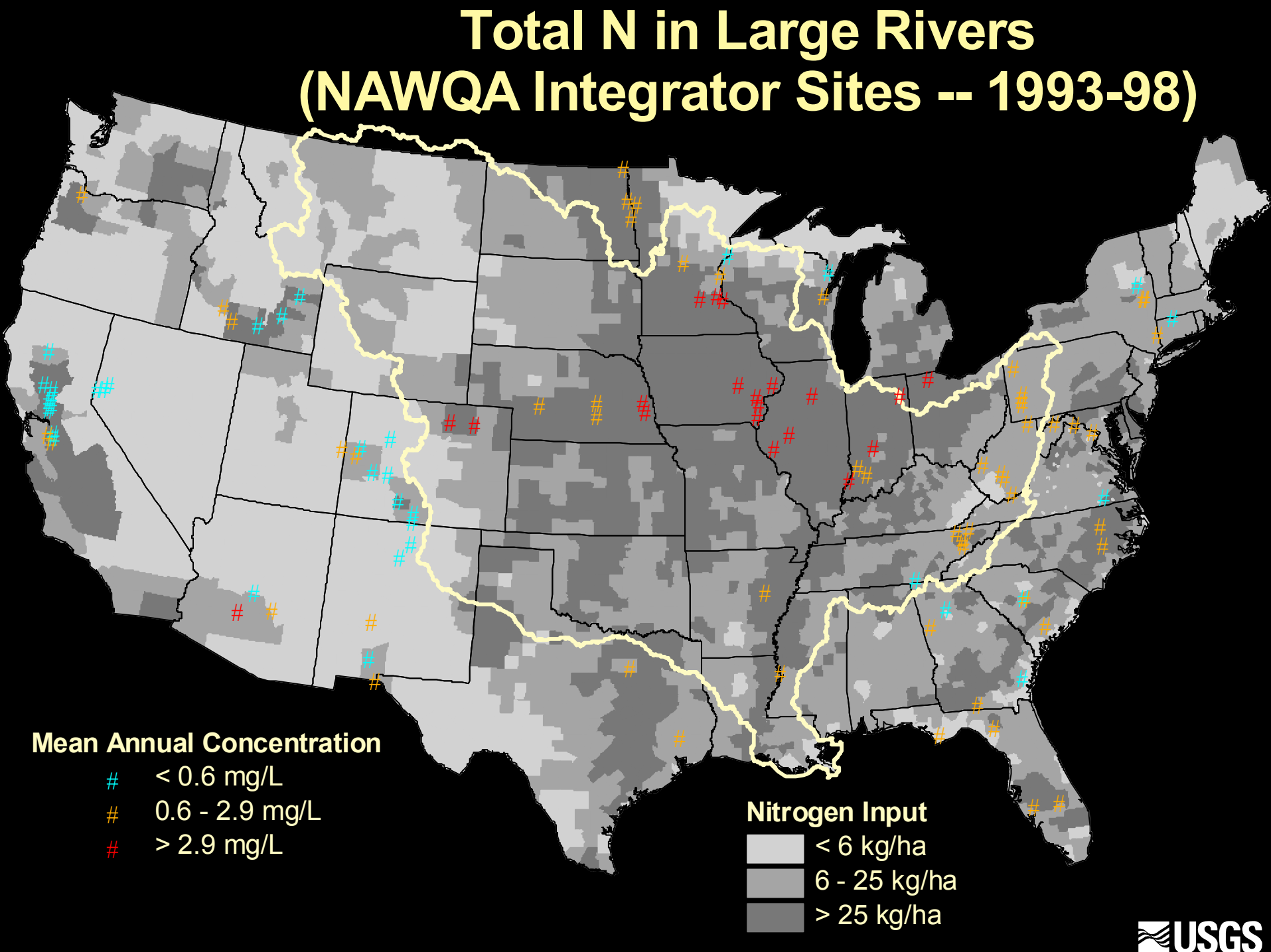
Total N in Large Rivers (NAWQA Integrator Sites -- 1993-98)



NAWQA Addresses Large-Scale, Long-Term Water Quality Issues

Some examples:

- Regional occurrence of contaminants and their relation to human-health and aquatic-life criteria.
- Relation of contaminant occurrence to anthropogenic and environmental factors.
- Effects of changing management practices on water quality.

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