U.S. Geological Survey

A valuable resource in assessing Missouri's past, present, and future water quality

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U.S. Department of the Interior
U.S. Geological Survey

USGS Facts

- USGS established in 1879
- Non-regulatory
- Continuous methods development
- Large scale work; standardized sample collection, processing, and analysis protocols
- Centralized storage of data with links to other data bases
- Multidisciplinary
- Science driven, quality motivated

USGS

USGS-MISSOURI WATER SCIENCE CENTER

In cooperation with:
Local and regional cities and municipalities
State departments
Federal agencies
Universities

Missouri Department of Natural Resources

NRCS

USGS

MoDOT

USDA

USGS Mission

The USGS provides the Nation with reliable, impartial information to describe and understand the Earth

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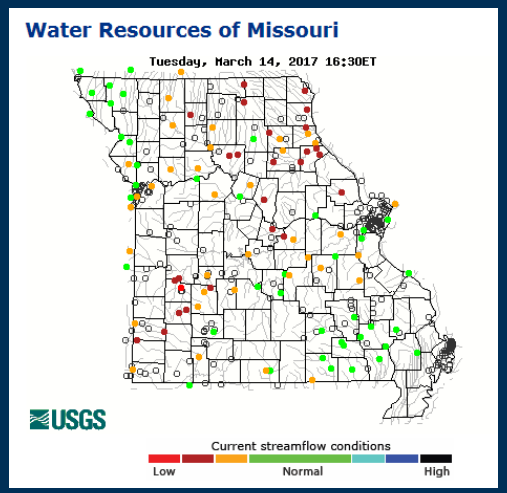
Missouri Water Science Center

- Surface water quantity—Streamgages
  - 273 real-time sites
- Groundwater
  - 169 real-time sites
- Surface-water quality
  - 26 real-time sites
  - 69 discrete in Ambient Network
- Precipitation
  - 181 sites available (28-day periods in real-time)
- Lakes/reservoirs
  - 14 real-time elevation sites



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Sampling Goals

- Obtain a representative sample
- Use “clean” sampling and processing techniques
- Measure unstable physical properties and chemical constituents at site
- Determine streamflow at time of sample collection
- Quality-assurance practices

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Typical Constituents Measured

- Physical Properties
- Nutrients
- Fecal Bacteria Indicators
- Major Ions
- Trace Elements
- Suspended Sediments and Solids
- Pesticides

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Why is streamflow important?

Chemical constituent concentration must be related to stream discharge

- To understand discharge-constituent relations
- To compute constituent transport loads

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AWQMN-History

- Established in 1964 with 18 stations
- Increased in 1986 to 41 stations
- Early 1990’s decreased to 5 stations
- 1994 Network grew to 39 stations
- Currently (2017) 69 stations

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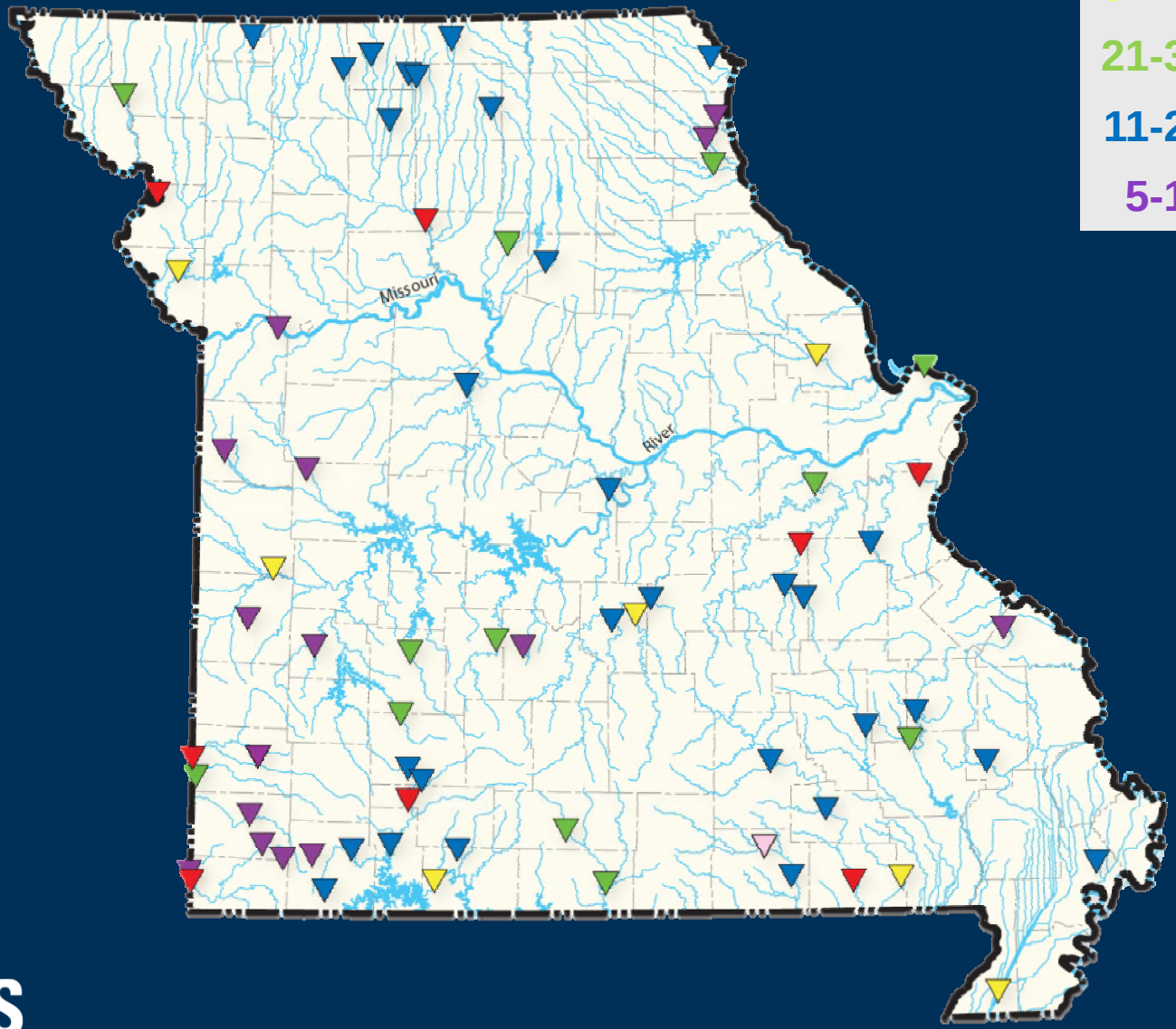
AWQMN Period of Record

> 40 years
31-40 years
21-30 years
11-20 years
5-10 years



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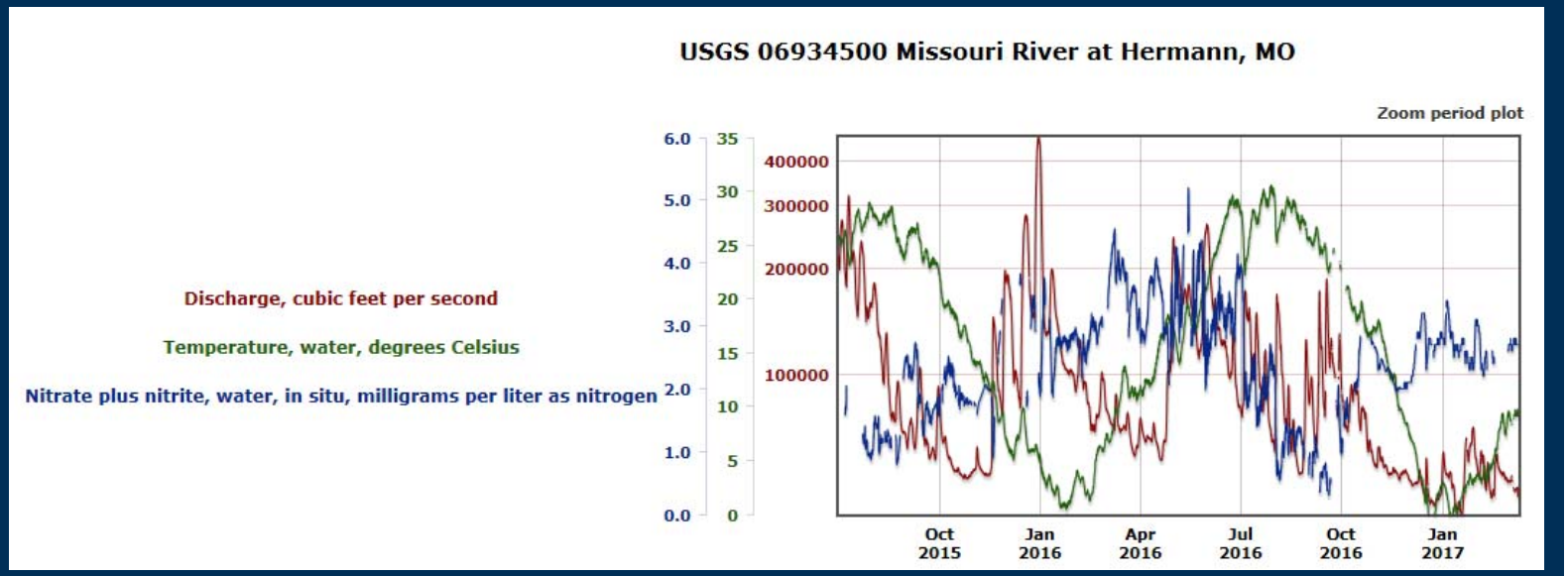
Continuous monitoring: Nitrate

Missouri River at Hermann &

Mississippi River at Cape Girardeau

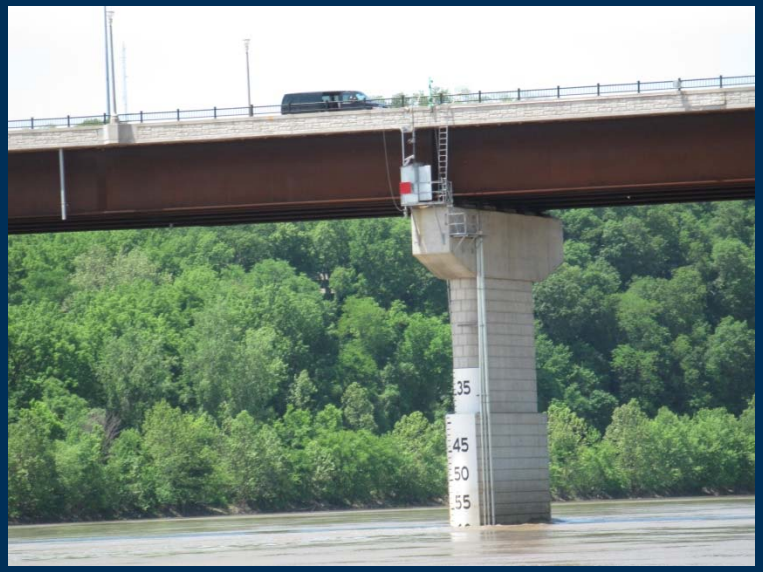
- **Help identify nitrate sources**
- **Nitrate load computations**
- **Relationships between turbidity, TSS, particulate nitrogen**



Missouri River at Hermann

- **NEW: Webcam!**

- **https://mo.water.usgs.gov/webcams/hermann.html**



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What are Nutrients?

- Nitrogen and phosphorus
  - Essential for plant growth
  - Occur naturally and human produced
    - Fossil fuel combustion, waste water treatment plants, fertilizer, animal manure
- Elevated levels cause:
  - Eutrophication
  - Harmful algal blooms
  - Decrease oxygen, light, habitat, and biodiversity
  - Gulf of Mexico hypoxic “dead” zone

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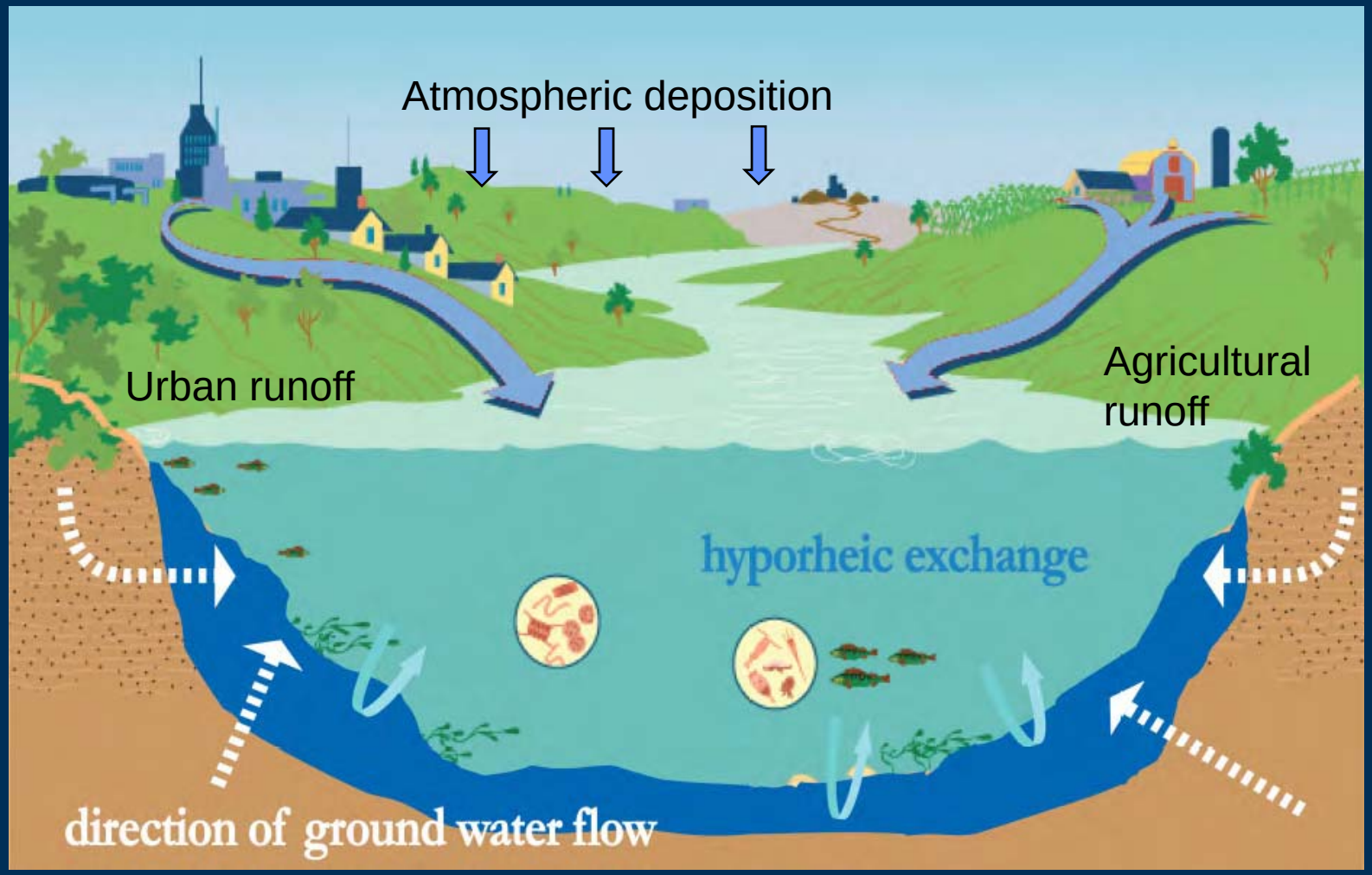
Sources of Nutrients



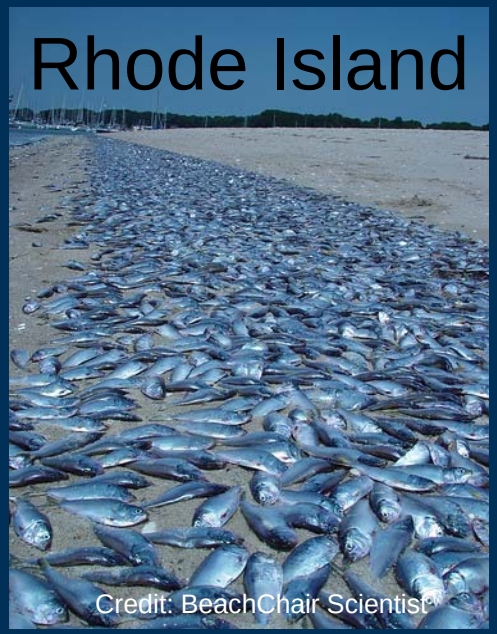
Modified from: https://wa.water.usgs.gov/neet/water_lecture_munn2015.pdf

Ecological Issues

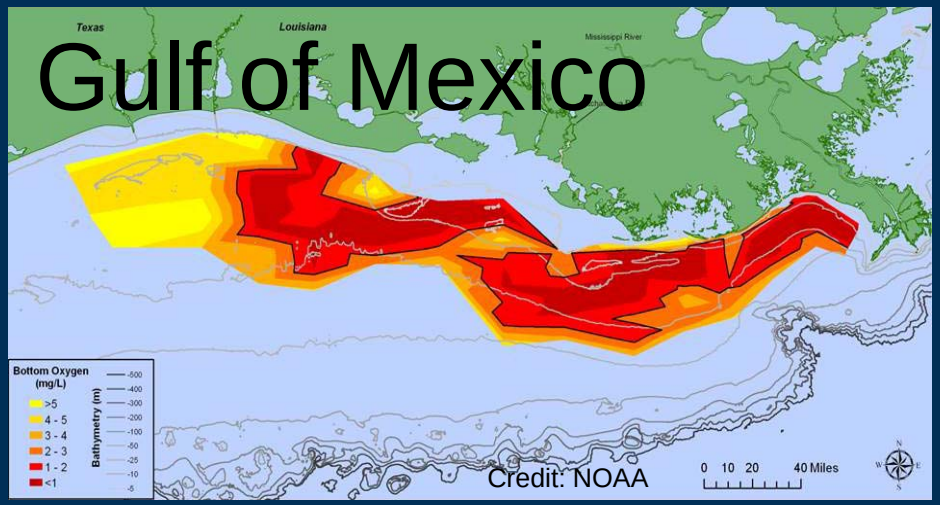
Credit: D.H. Wilkison

Credit: U.S. Department of Agriculture

Credit: J.L. Graham, USGS



Credit: BeachChair Scientist



Credit: NOAA

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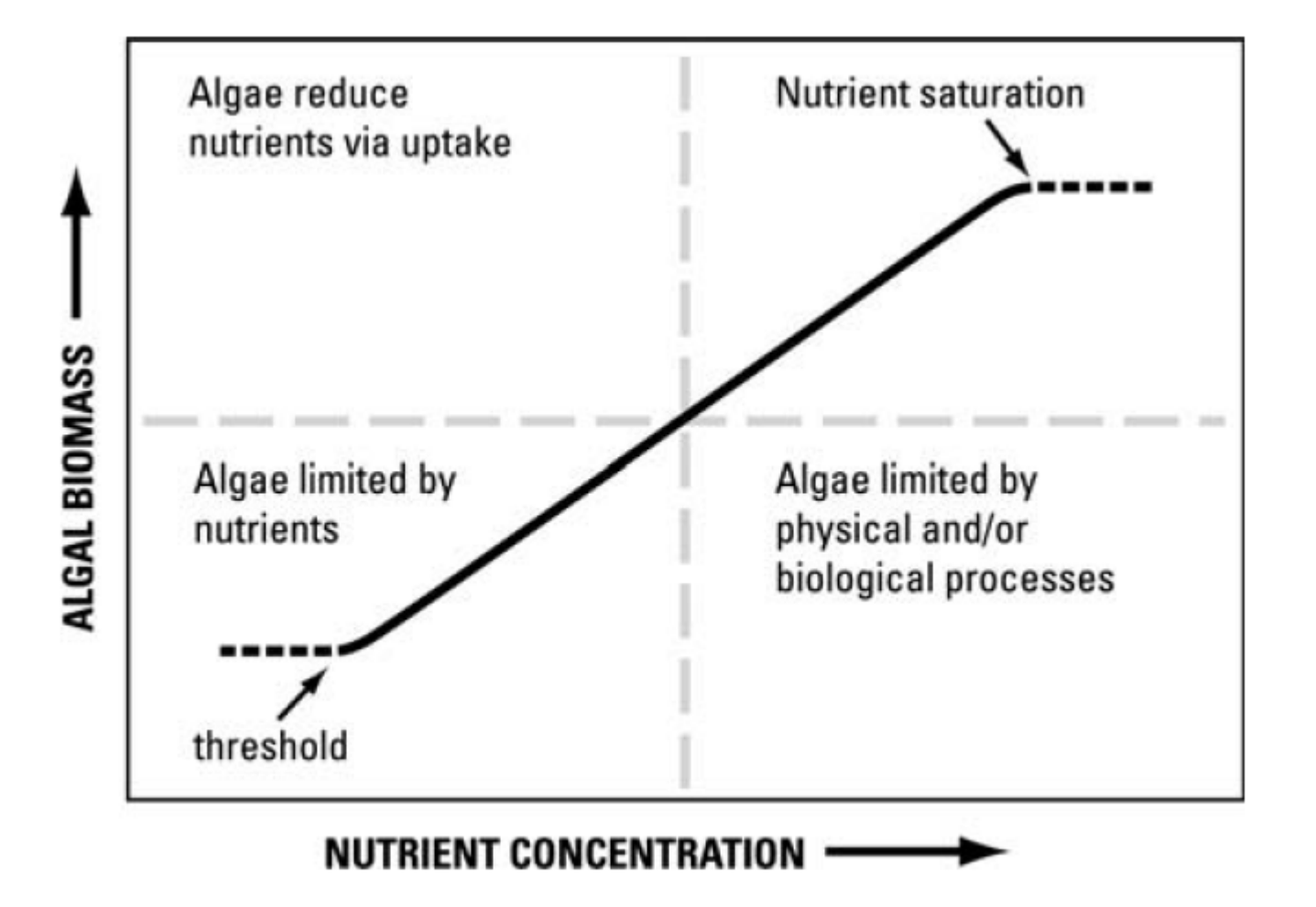
Vegetation Response to nutrients



Munn, M., Frey, J., & Tesoriero, A. (2010). The Influence of Nutrients and Physical Habitat in Regulating Algal Biomass in Agricultural Streams. *Environmental Management*, *45*(3), 603–615. http://doi.org/10.1007/s00267-010-9435-0

National Water Quality Assessment

Informing Decision Makers—Linking Science to Water Management and Protection

- Support development of regulations, standards, and guidelines Identify key sources of nonpoint pollution in agricultural and urban areas
- Prioritize geographic areas, basins, and aquifers, where improved treatment or management can have the greatest benefits
- Contribute to State assessments strategies
- Sustain the health of aquatic ecosystems through improved stream protection and restoration management.
- Improve strategies and protocols for monitoring, sampling, and analysis of all hydrologic components
- Develop chemical and ecological indicators stream impairment, nutrient enrichment, and urbanization

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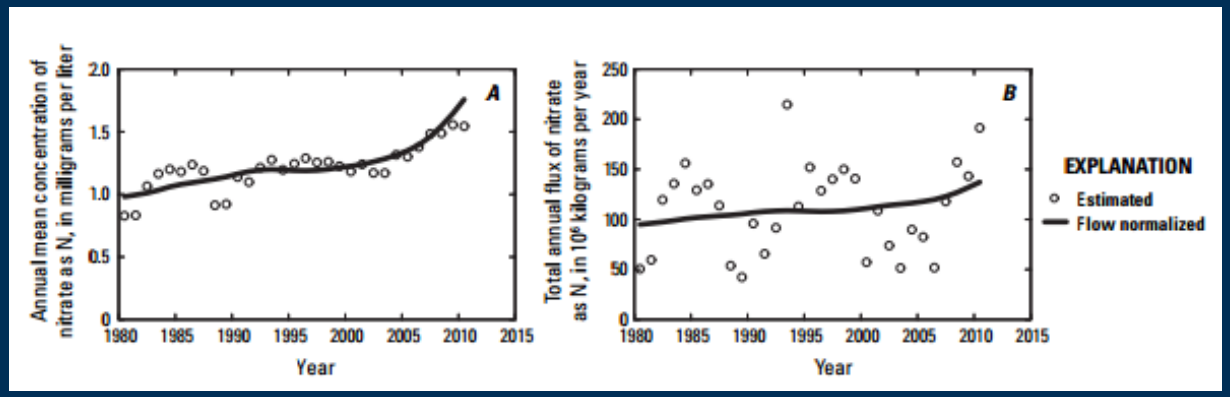
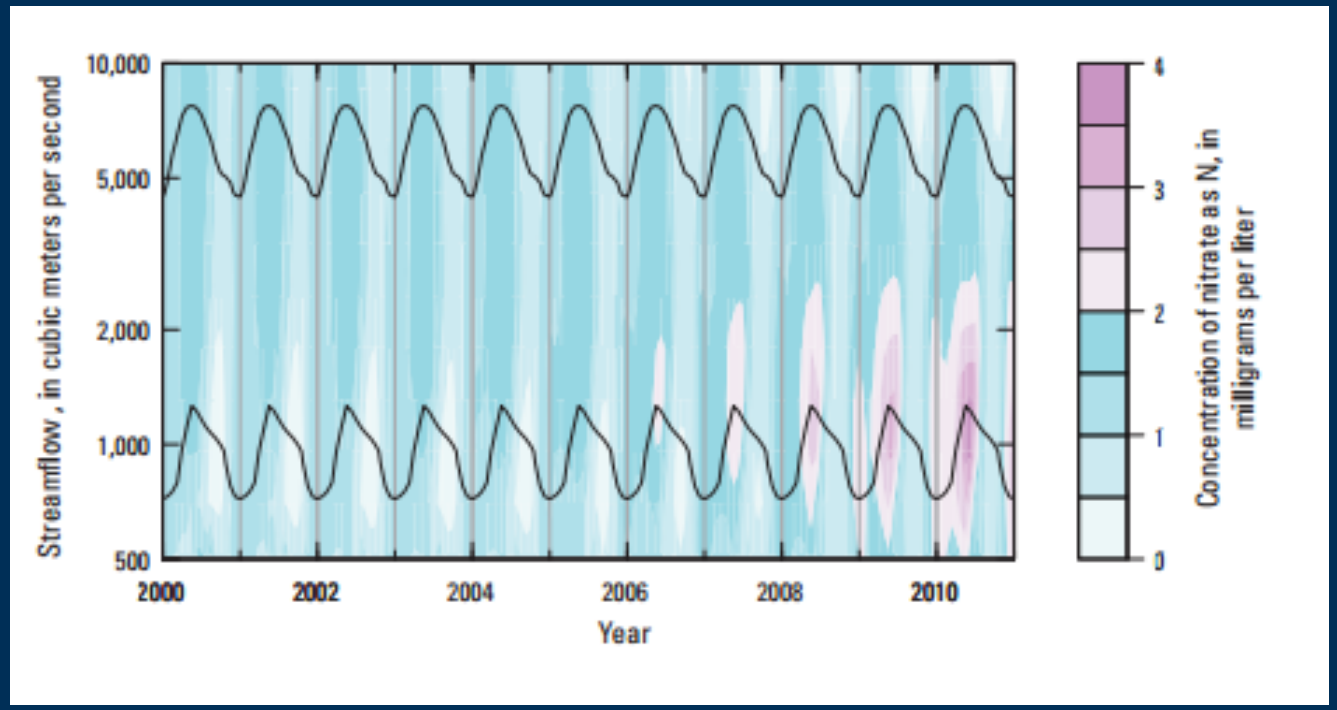
Nitrate trends: Are we making progress?



Nitrate in the Mississippi River and Its Tributaries, 1980–2010: An Update

By Jennifer C. Murphy, Robert M. Hirsch, and Lori A. Sprague

SIR 2013:5169



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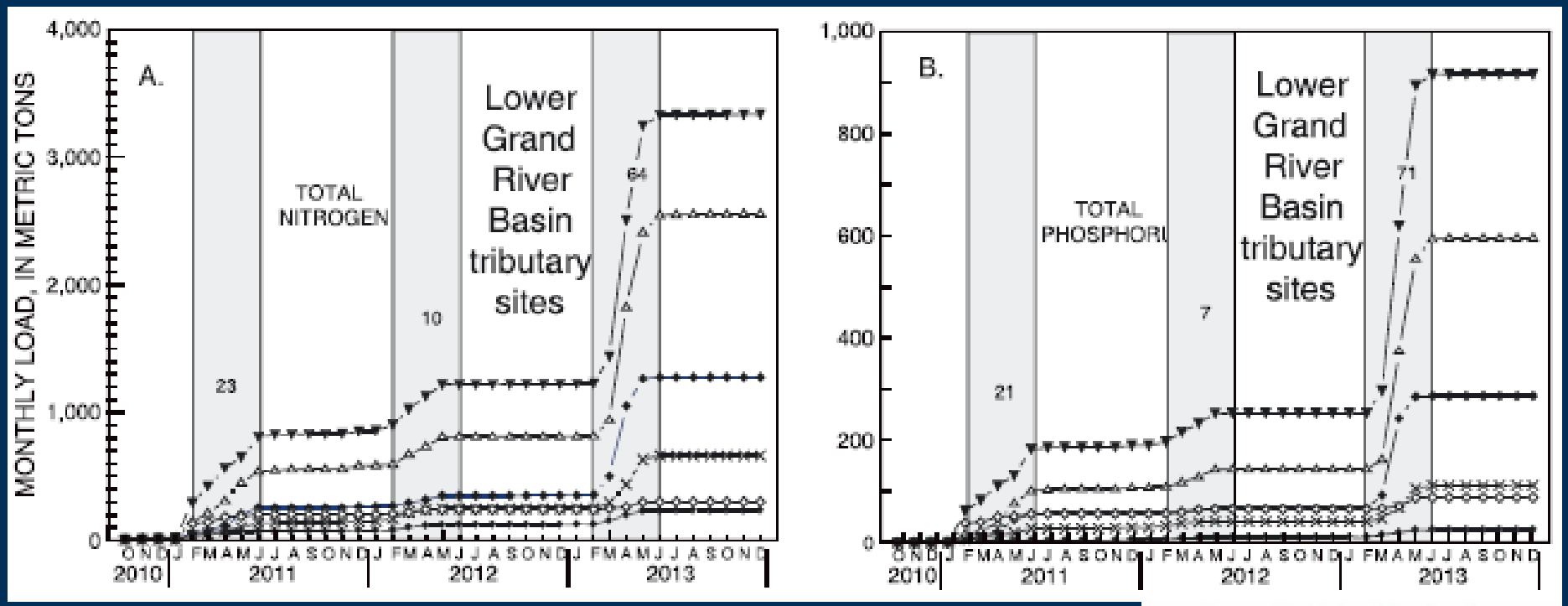
Nutrient Concentrations in the Lower Grand River



- **Most (>95%) of nutrient transport occurred during February – June**
- **Period of increased streamflow and coincides with corn and soybean planting and growth in N. MO**

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What Has Changed?

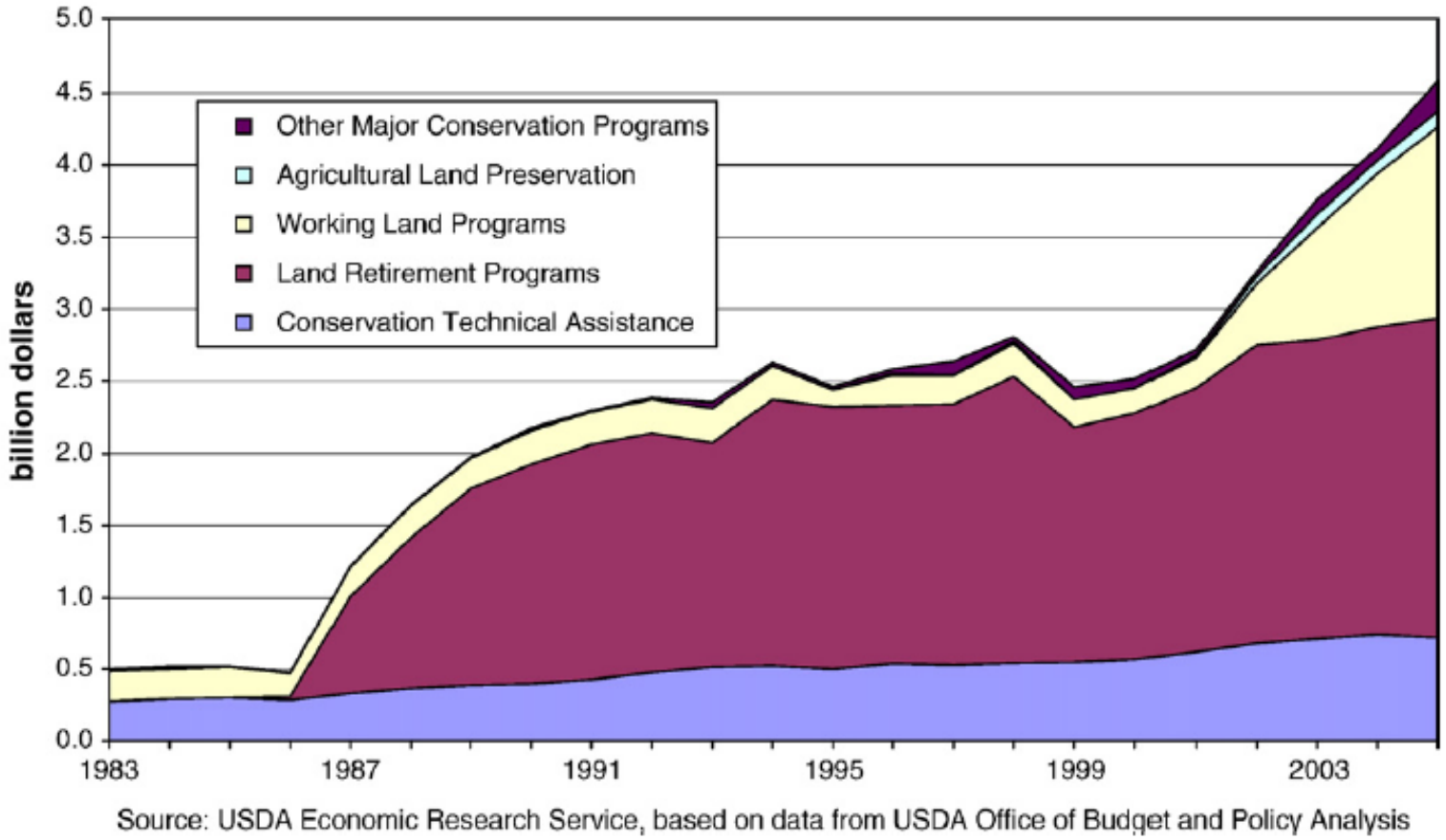

Fig. 2 – Major USDA conservation expenditures 1983–2005.

Claassen R, Cattaneo A, Johanssson R. 2008. Cost-effective design of agri-environmental payment programs: U.S. experience in theory and practice. Ecological Economics 65: 737–752. DOI: 10.1016/j.ecolecon.2007.07.032

USGS

Future Efforts

- Nutrient trends mapper
- Surrogate capabilities
- HAB analyses
- Continuous monitoring opportunities
- Working across borders/agencies/land uses
- Public awareness

From: New York Dept. of Environmental Control