USGS
science for a changing world

New Capabilities and Future Plans for Improving the Understanding of Stream Water Quality Across the Nation

Steve Preston and Mike Woodside
National Water Quality Assessment Program
U.S. Geological Survey




Lake Erie's Toxic Algae Crisis May Not Be Over

USA Today, August 8, 2014

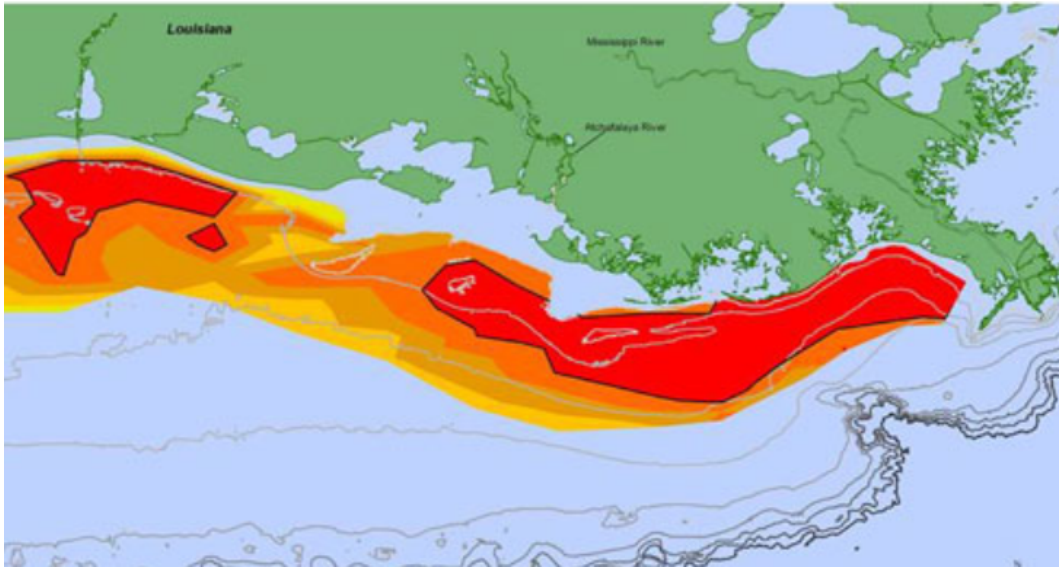
Lake Erie not alone in suffering from harmful algae

Maryland lakes closed to swimming, Baltimore's reservoirs safe -- for now -- but all are threatened by same nutrient pollution fouling the Chesapeake.

Baltimore Sun, August 6, 2014

2014 Gulf of Mexico Dead Zone has grown to 5,052 square miles

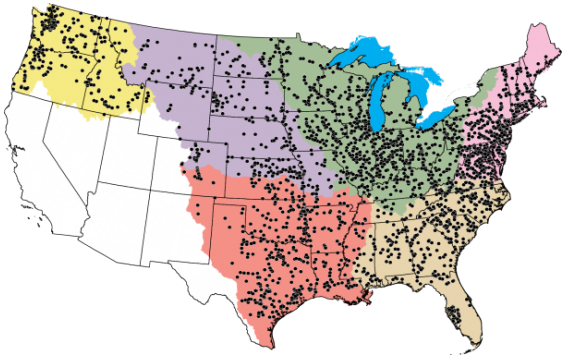
EarthSky, August 18, 2014



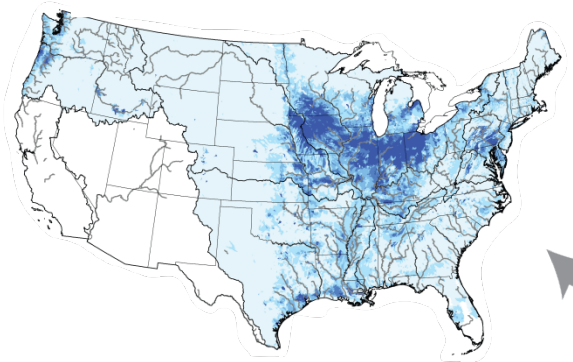
SPARROW Water-Quality Model

***SPA**tially **R**eferenced **R**egression **o**n **W**atershed Attributes)*

Monitoring Data



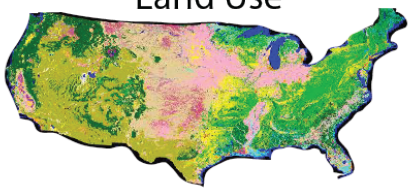
Model Predictions



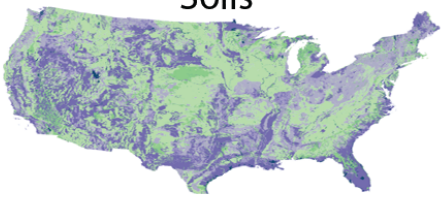
Geographic Data Layers

Precipitation

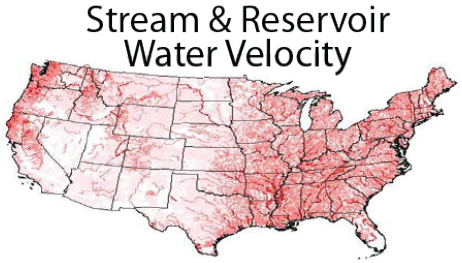
Land Use



Soils



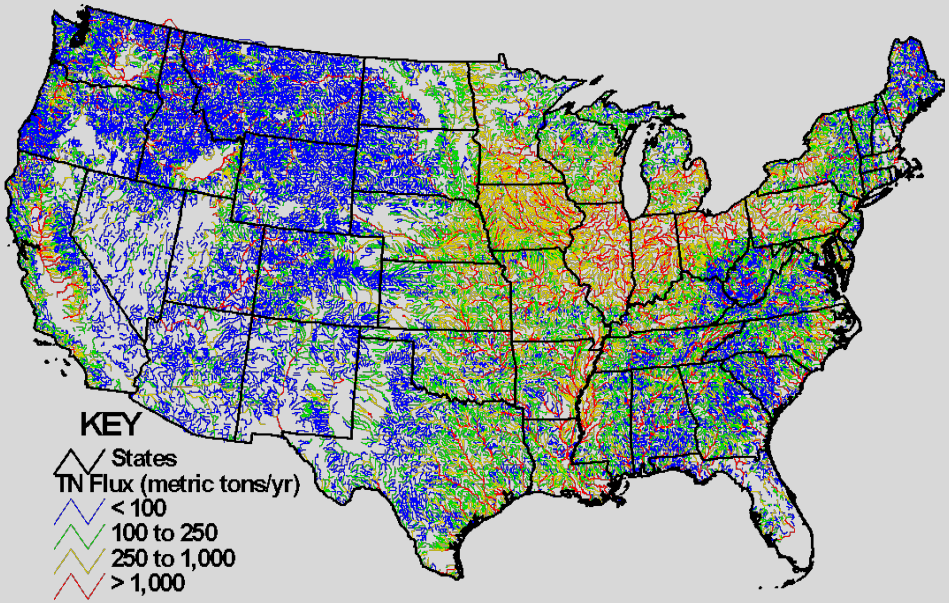
Stream & Reservoir Water Velocity



USGS

Large Scale Applications

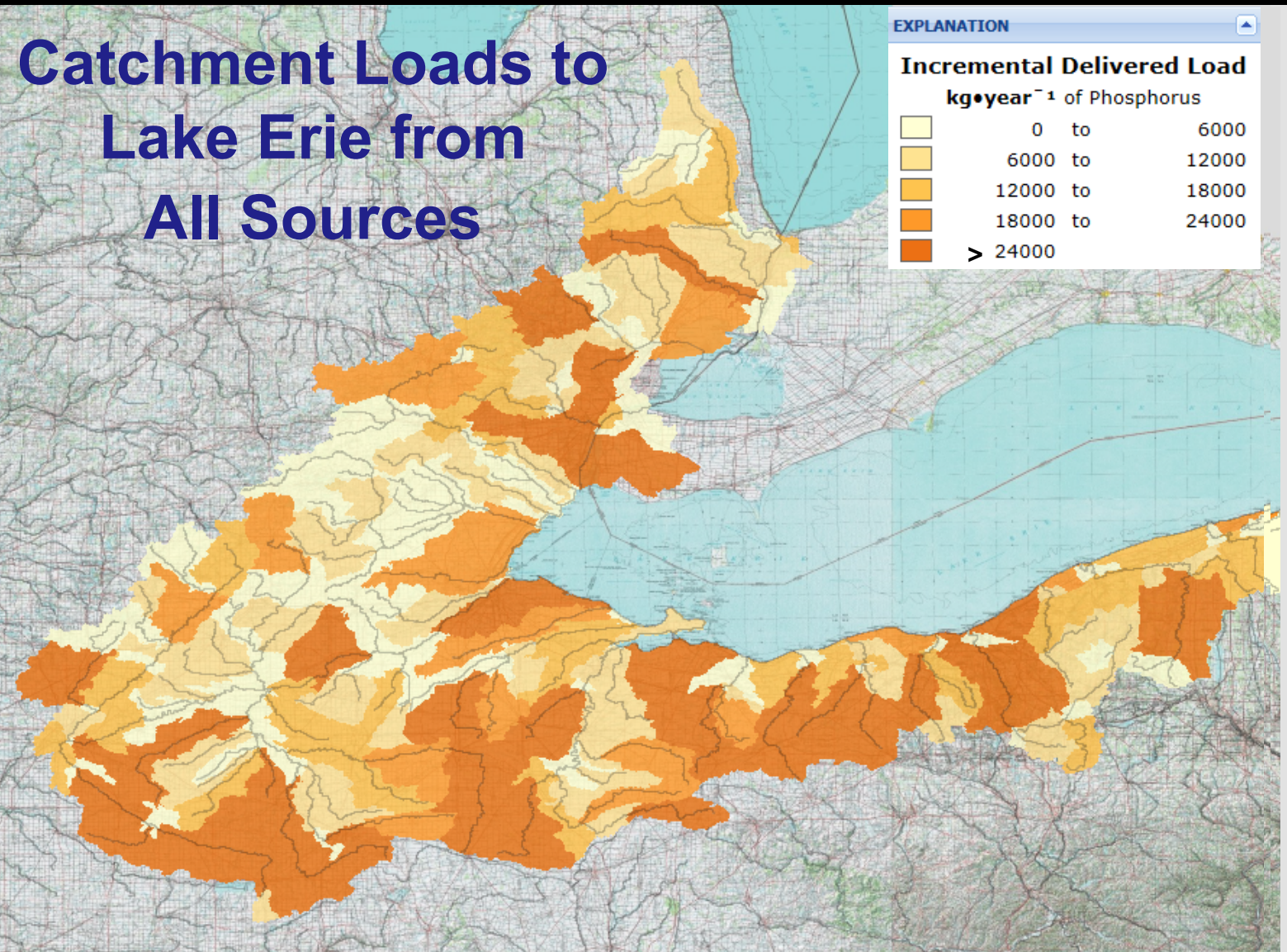
Predictions of Stream Nitrogen Load



- Predict mean-annual load, yield or concentration for unmonitored streams
- Predict contaminant load to downstream receiving waters such as estuaries
- Apportion stream loads to major nutrient sources and upstream watersheds
- Provide a framework for prioritizing areas for management actions
- Evaluate the potential effects of landscape change scenarios on water quality

USGS

Lake Erie Algal Bloom



USGS

Newly Developed Models

East Coast Nutrient Models

- Objective – assess nutrient loads to Eastern estuaries
- Improvements – atmospheric dep. / wetlands data

National Salinity Model

- Objective – estimate salinity levels in streams nationally
- Improvements – national scope

USGS

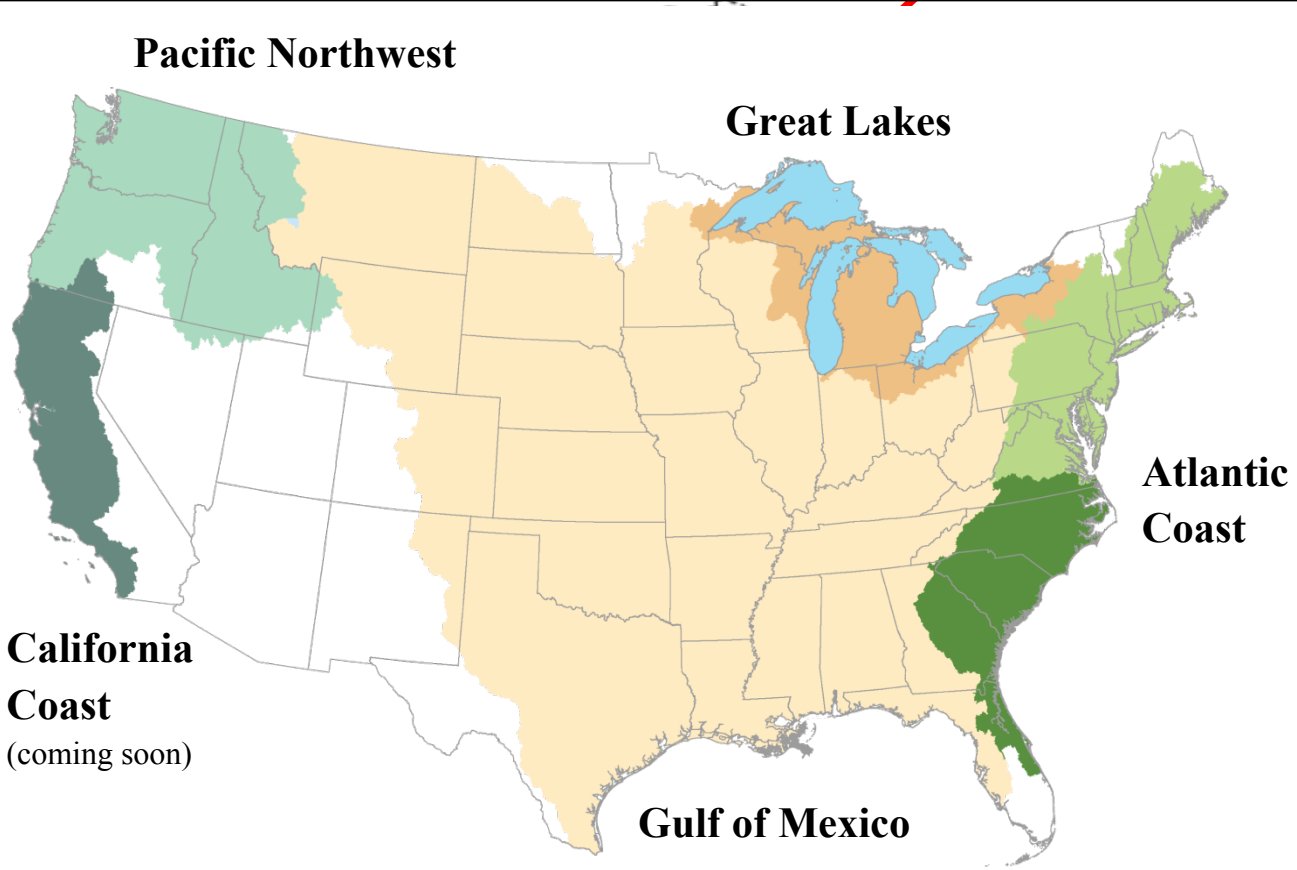
Web-Based Information Access

Online Mapping / Decision Support Systems

1. Static Map Summaries
   - Nutrient Loads to the Nation's Estuaries
2. Basic Mapping Choices and Flexibility
   - Mississippi / Great Lakes Mapping System
3. Detailed Mapping / Model Application
   - SPARROW Decision Support System

USGS

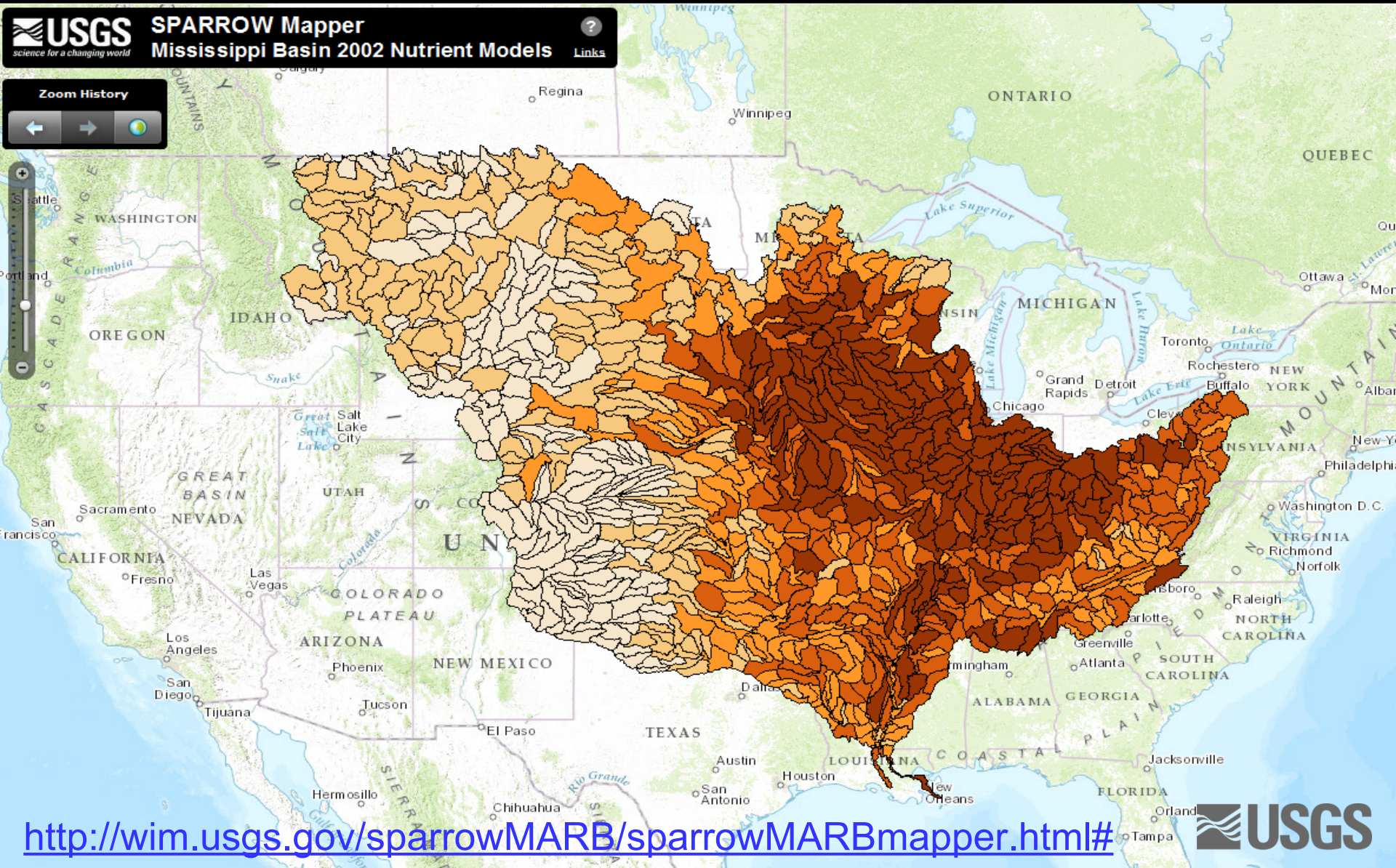
Tracking Nutrient Loading to the Nation's Estuaries and Great Lakes



http://water.usgs.gov/nawqa/sparrow/estuary

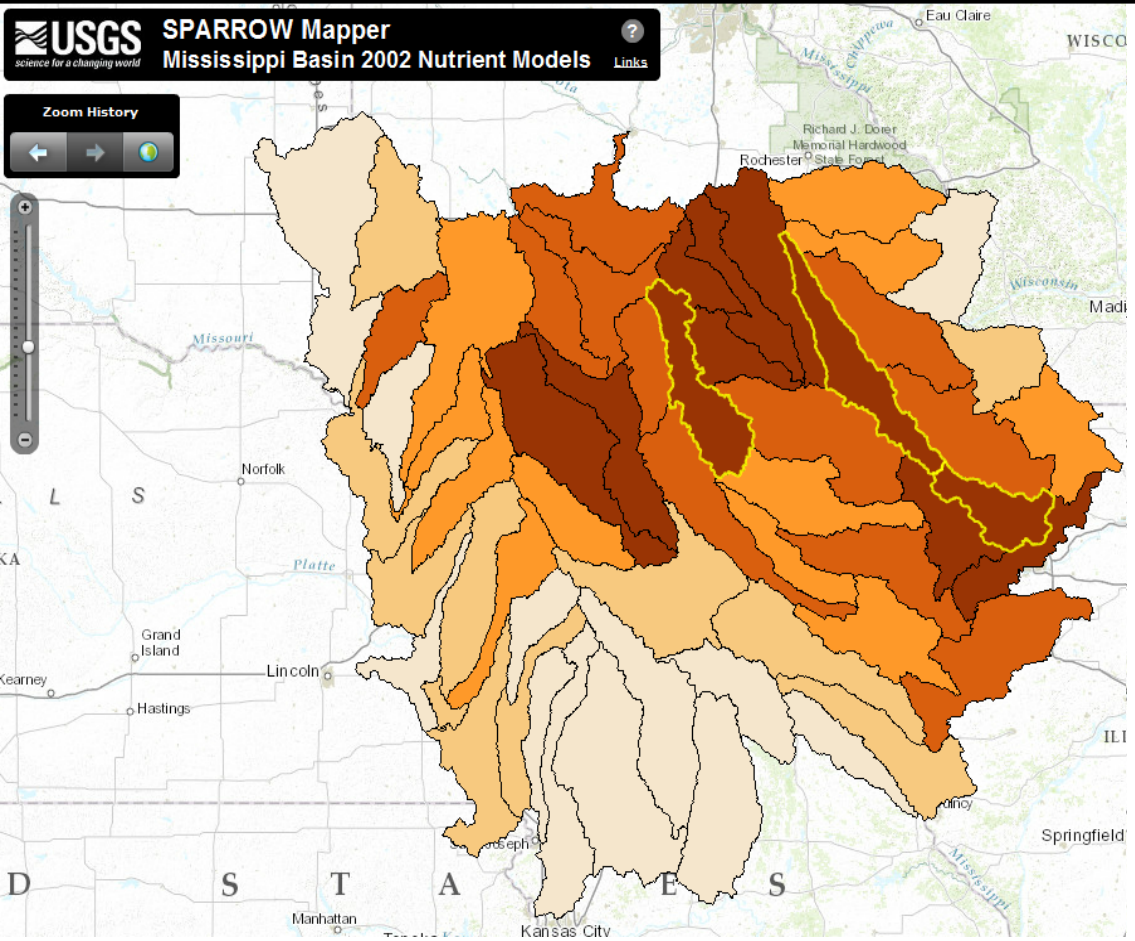
USGS

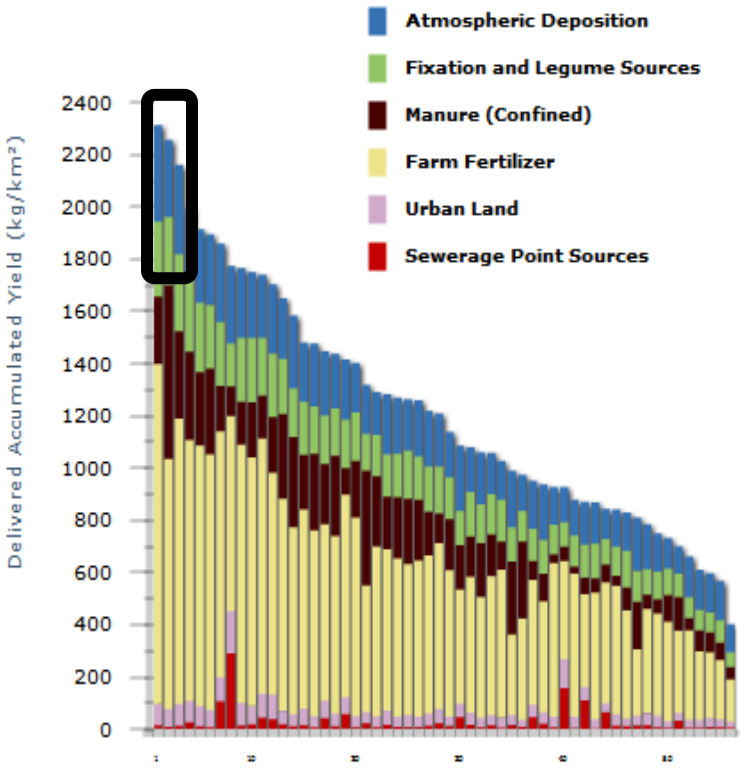
Mississippi River / Great Lakes Mapper



http://wim.usgs.gov/sparrowMARB/sparrowMARBmapper.html#

Ranking Iowa Watersheds by Nitrogen Yield to the Gulf of Mexico

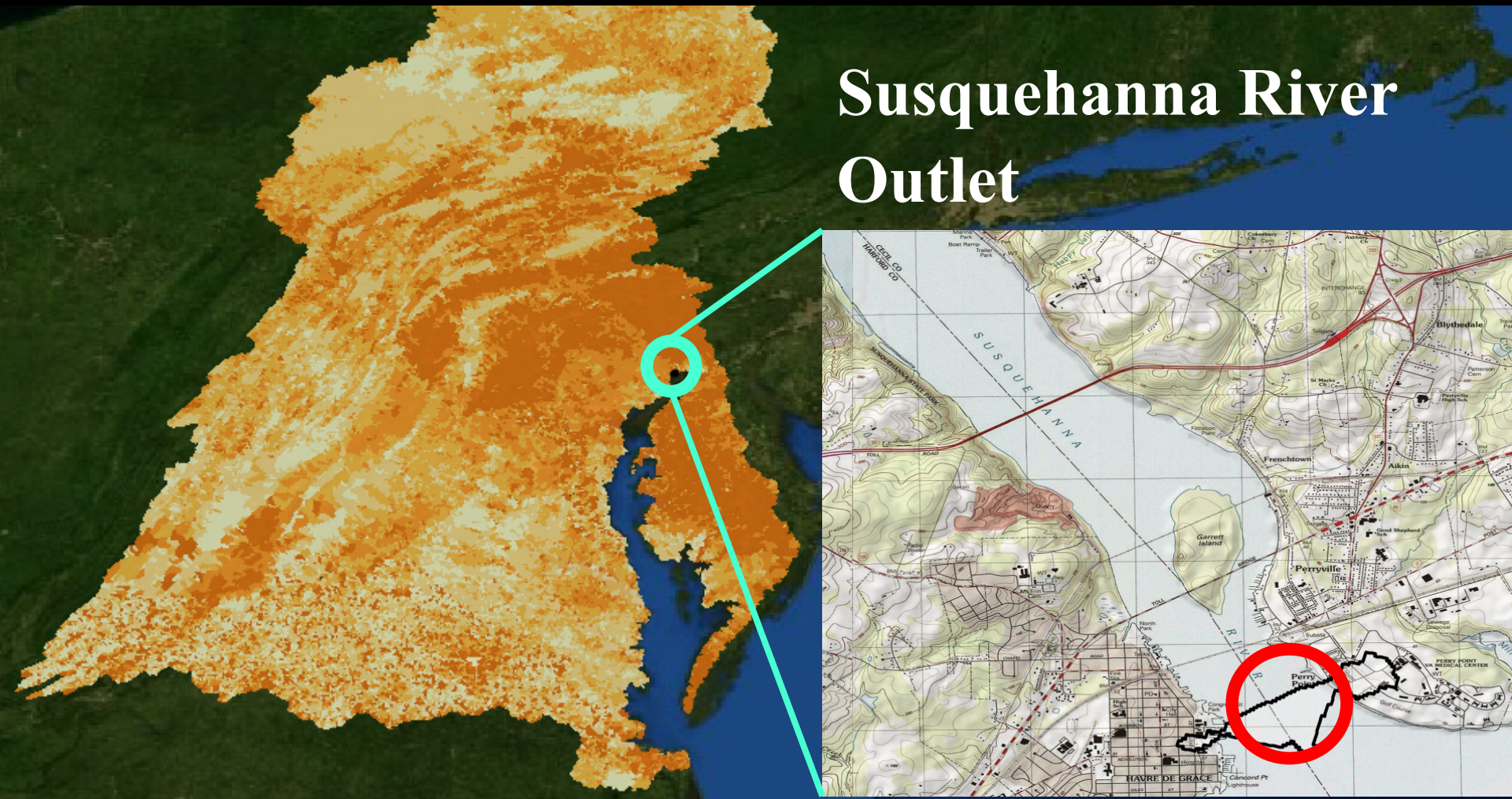




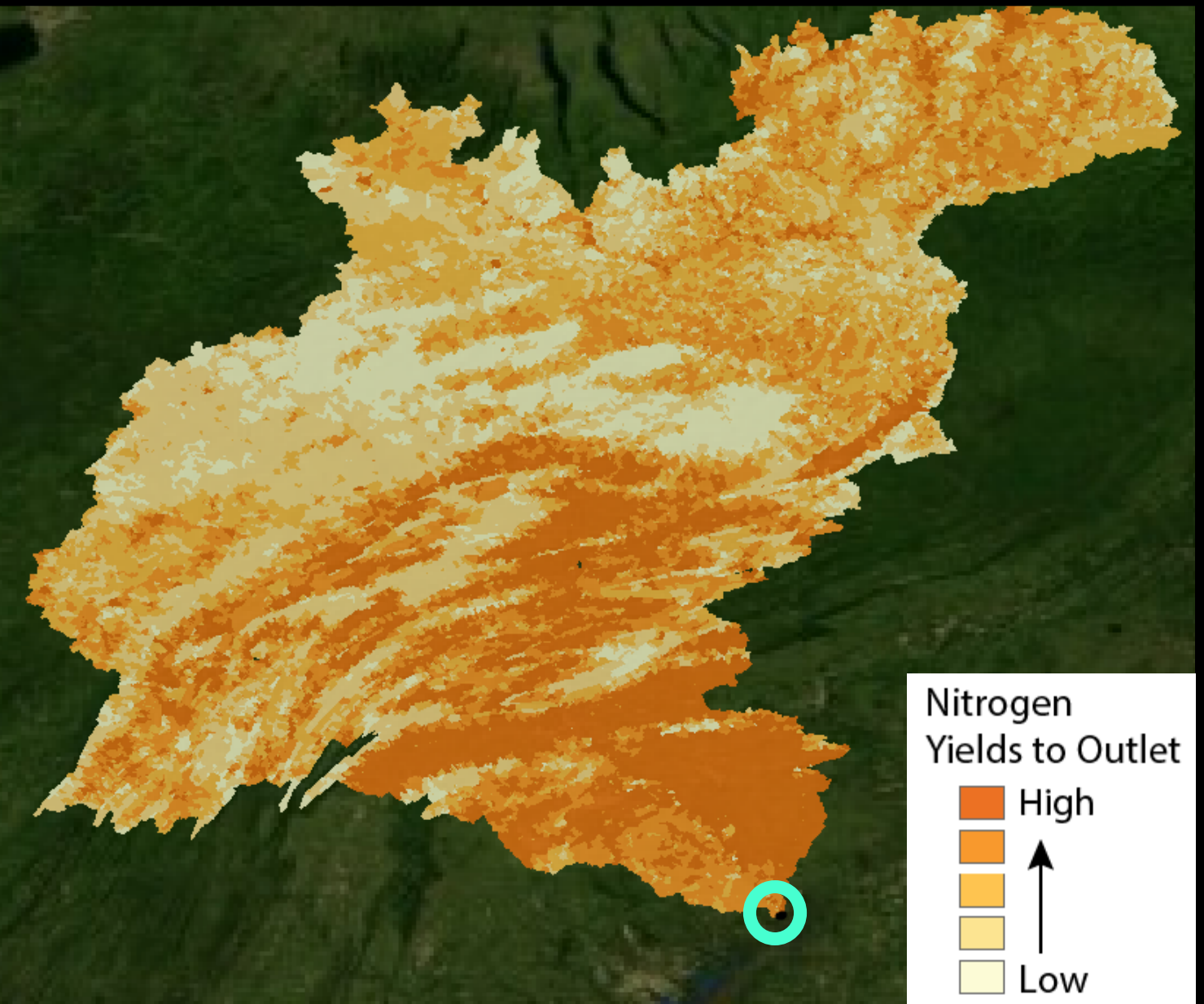
USGS

Decision Support System

Map Nutrient Sources and Areas Contributing the Largest Amounts of Nutrients to ANY Stream Outlet



Decision Support System



Map

Nutrient Sources

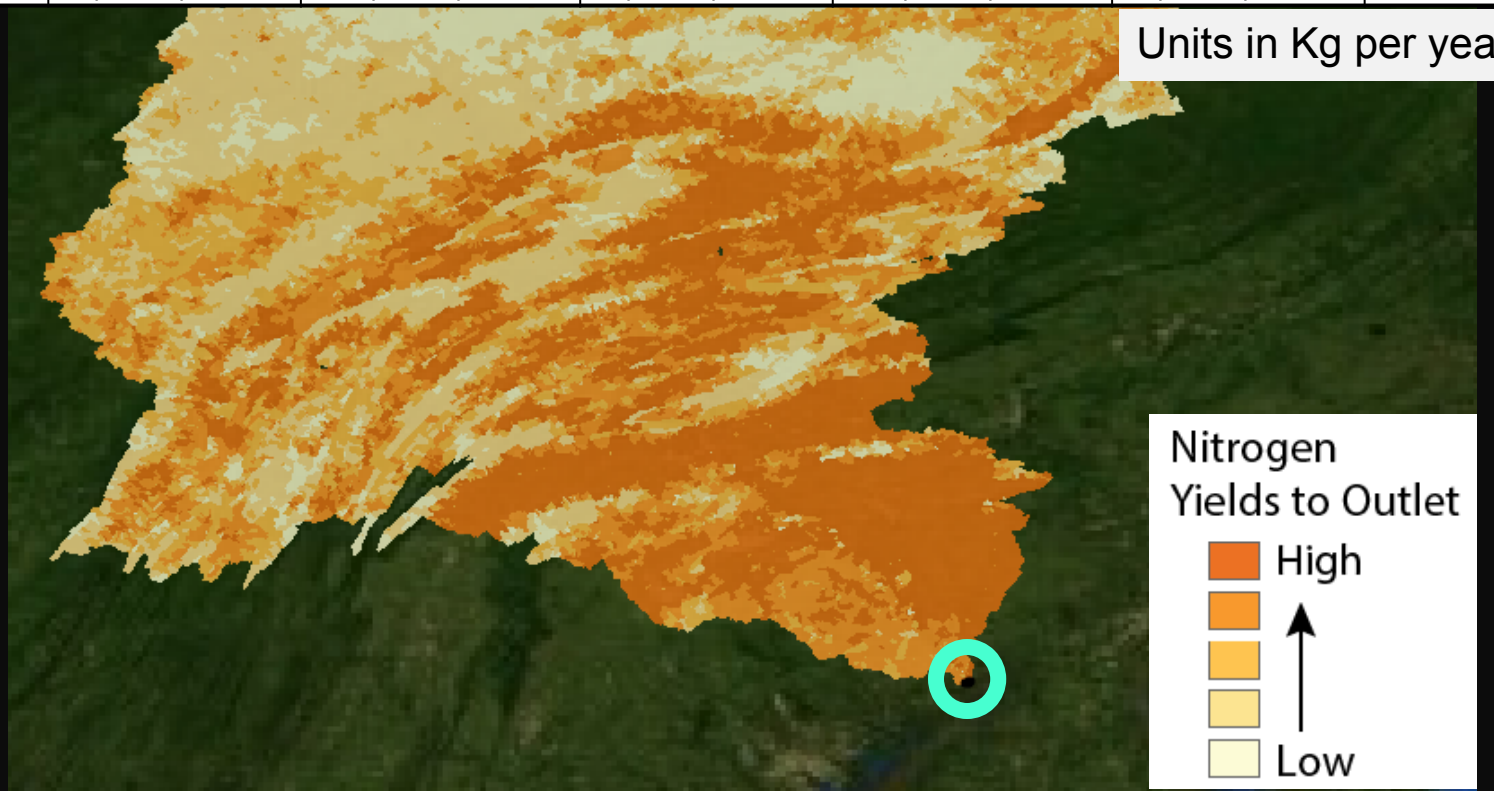
Nutrient Yields and Loads to Local Watersheds

Nutrient Yields and Loads Delivered to Stream Outlet

Decision Support System

State Nitrogen Contributions to ANY Stream Outlet

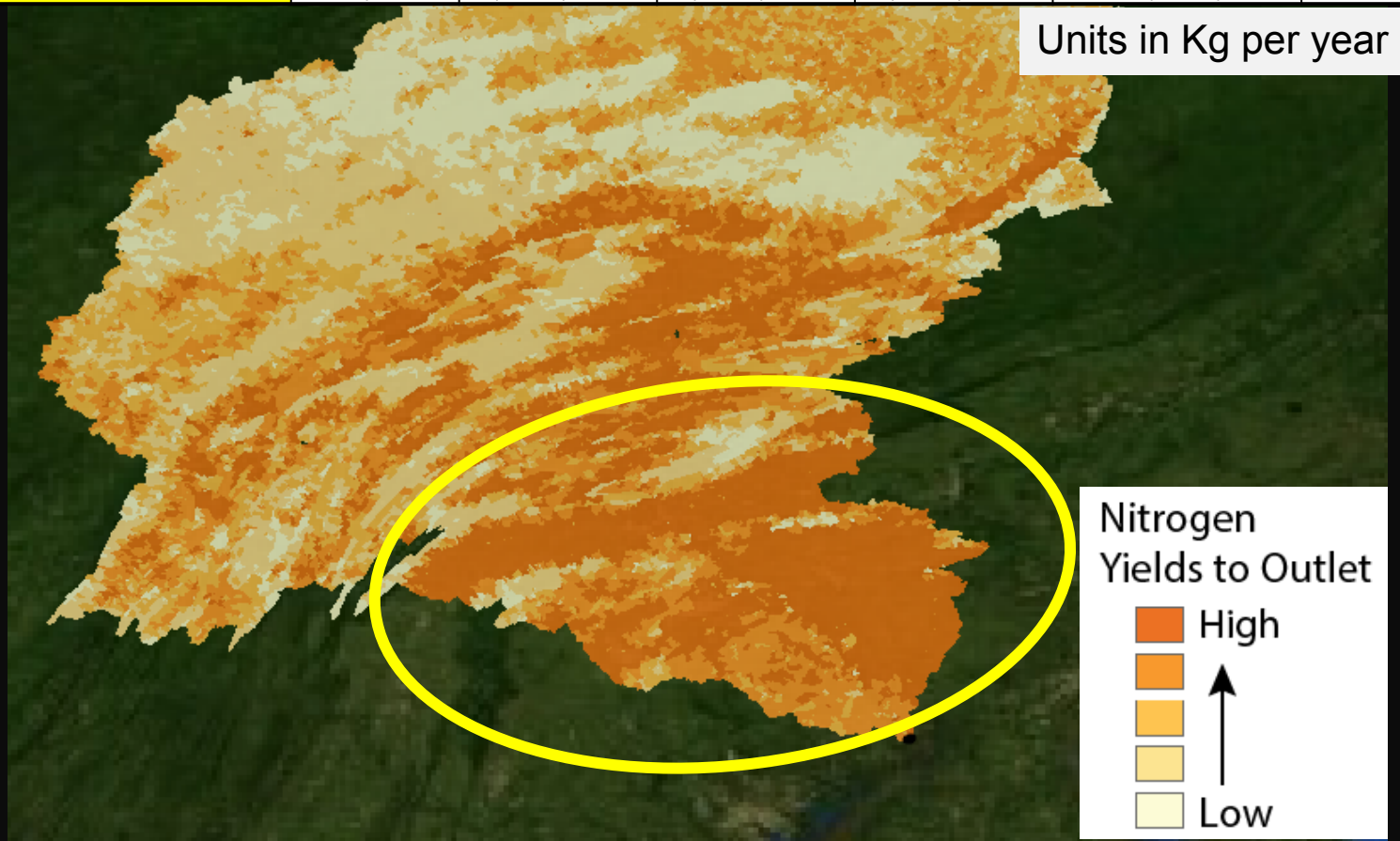
State	Point Sources	Fertilizer	Manure	Air Deposition	Urban	Relative Percent
MD	6,751	487,767	40,057	107,202	28,073	1
NY	1,274,471	5,305,472	674,337	2,219,309	942,511	16
PA	4,773,783	25,638,762	5,845,893	10,650,054	6,717,274	83



Decision Support System

Watershed Nitrogen Contributions to ANY Stream Outlet

Hydrologic Area	Point Sources	Fertilizer	Manure	Air Deposition	Urban	Relative Percent
LOWER SUSQUEHANNA	966,048	8,609,018	2,750,827	1,360,775	1,377,950	23



Decision Support System

Nutrient Reduction Scenario - Susquehanna River Basin

Reduce Nitrogen Sources by 25%

Reduction in Nitrogen Load to Outlet

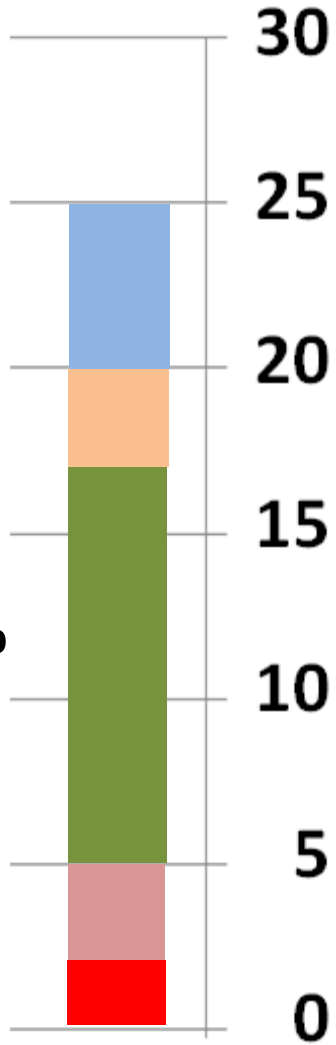
Atmospheric Deposition **5 %**

Manure **3 %**

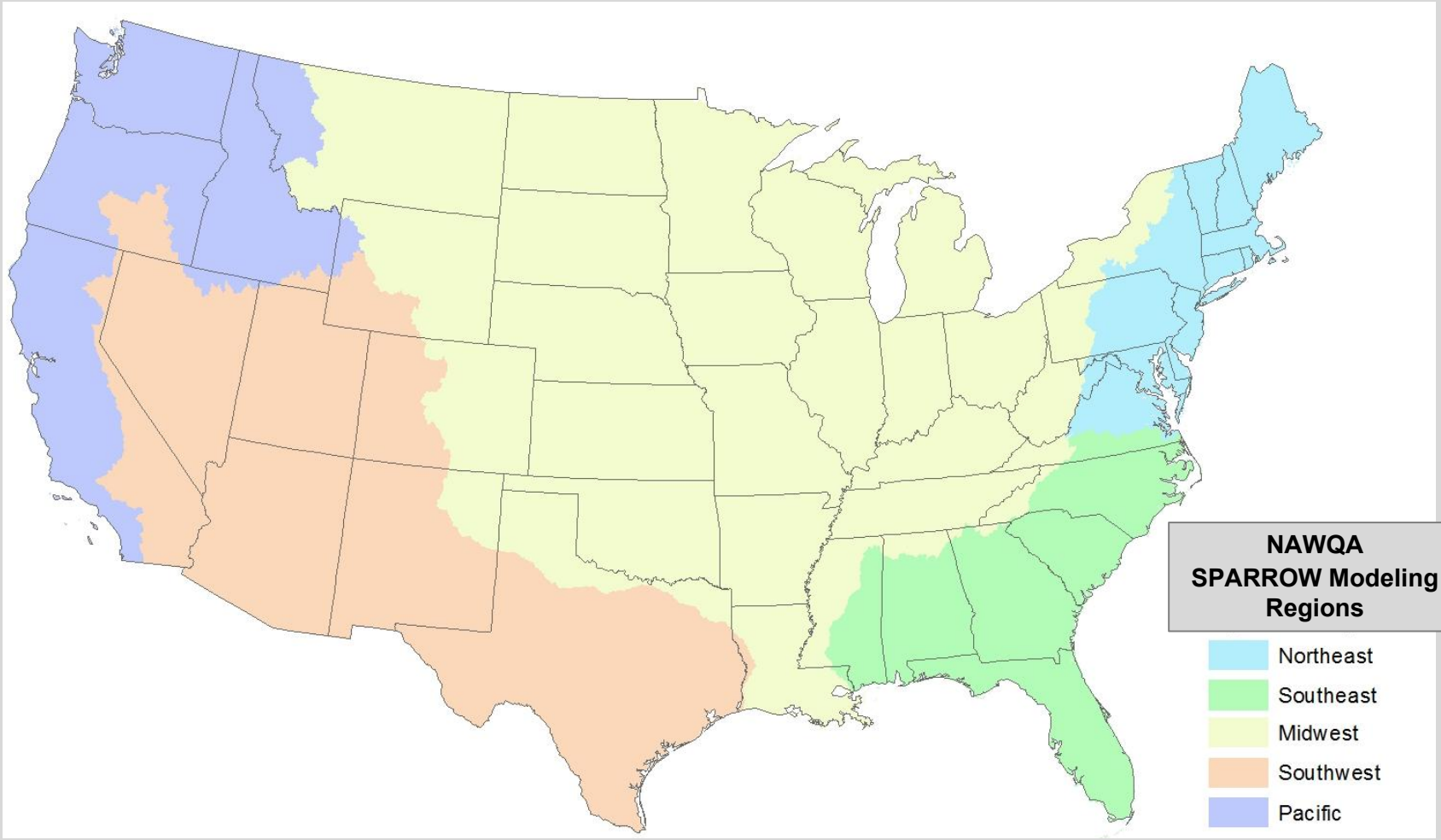
Fertilizers **12 %**

Urban Sources **3 %**

Point Sources **2 %**



Regional SPARROW Modeling Areas and Improvements



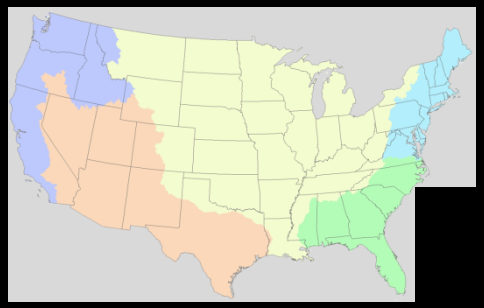
USGS

Limitations in NAWQA Cycle 3 Plans

- Are current management actions reducing nutrient loads?
- How long for planned management actions to work?
- How and why are loads varying in time?
- What is the most cost efficient way to reduce loads?

USGS

Additional Information



SPARROW Information:

http://water.usgs.gov/nawqa/sparrow

Nutrient Transport to the Nation's Estuaries:

http://water.usgs.gov/nawqa/sparrow/estuary

Mississippi River Mapper:

http://wim.usgs.gov/sparrowMARB/sparrowMARBmapper.html#

Decision Support System:

http://water.usgs.gov/nawqa/sparrow/dss

Contact Information:
spreston@usgs.gov

USGS