USGS Research on Biofuels Sustainability

Assessing the Effects of Corn-Based Ethanol Production on Stream Water Quality

National Academies' First Federal Sustainability Research and Development Forum

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USGS Research on Biofuel Production Effects on the Nation's Water Resources

- Long-term research goals: Biofuel production implications for the quantity and quality of U.S. surface and ground waters

- Initial research: Corn-based ethanol production effects on stream nutrients (nitrogen, phosphorus) and delivery to coastal waters

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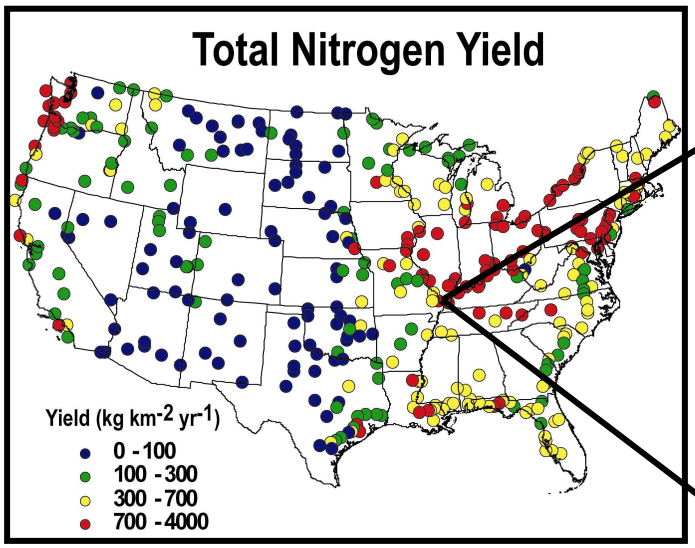
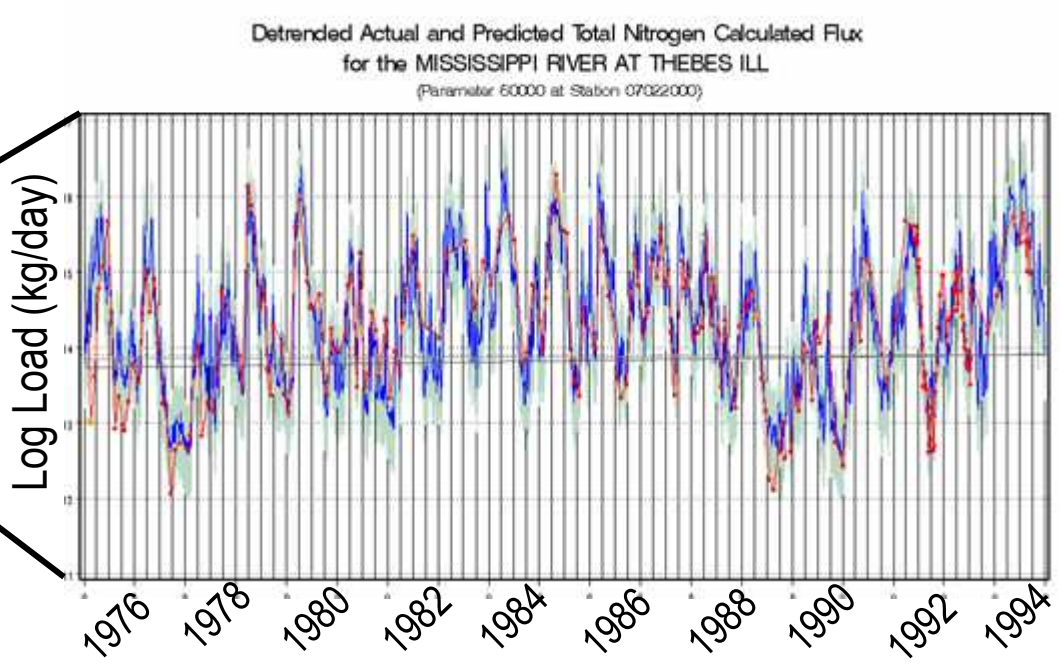
USGS monitoring and statistical evaluations of stream nutrient and flow data: Essential resources to support water-quality modeling

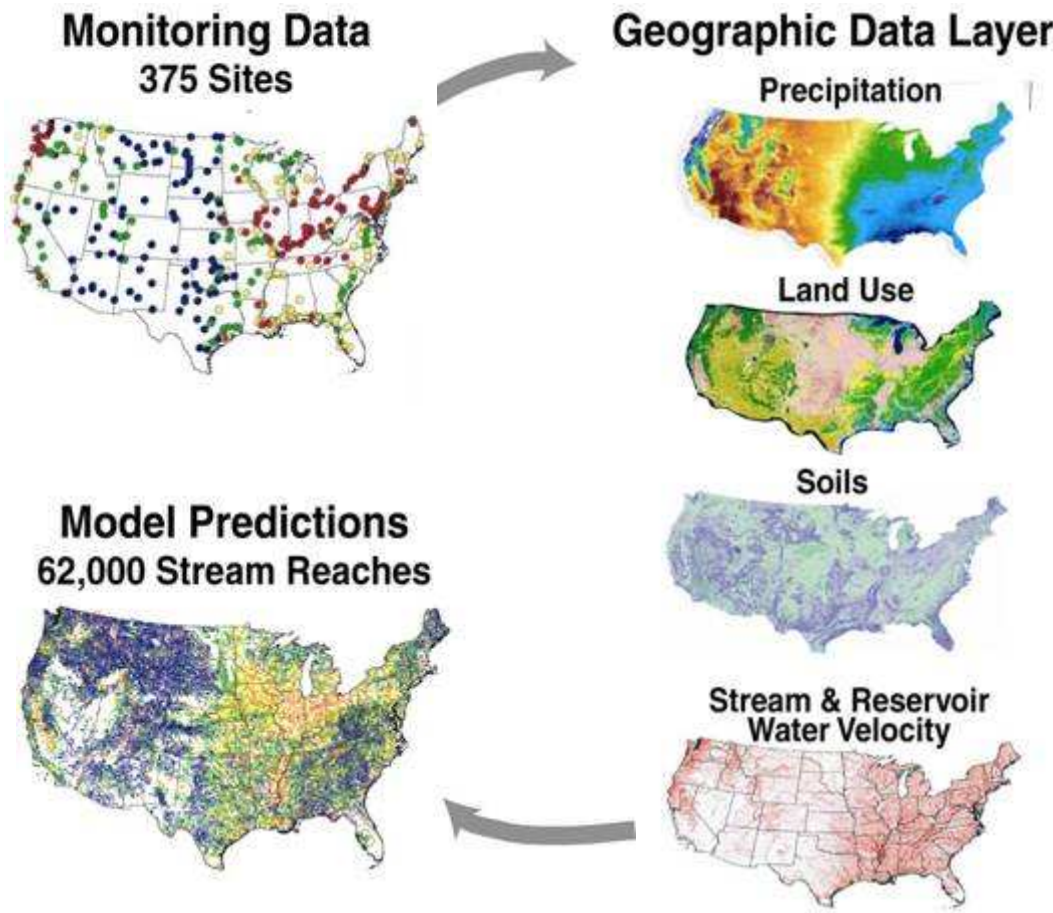




SPARROW National Water-Quality Model

SPAtially Referenced Regression on Watershed Attributes

http://water.usgs.gov/nawqa/sparrow; Smith et al. 1997



- Spatially explicit, data-driven model relates major pollutant sources to in-stream measurements
- Includes agricultural land uses and nutrient inputs from crop and livestock production
- Accounts for non-conservative transport in watersheds
- Predicts mean annual loads/concentrations (and uncertainties) in streams for 1992 and 2002

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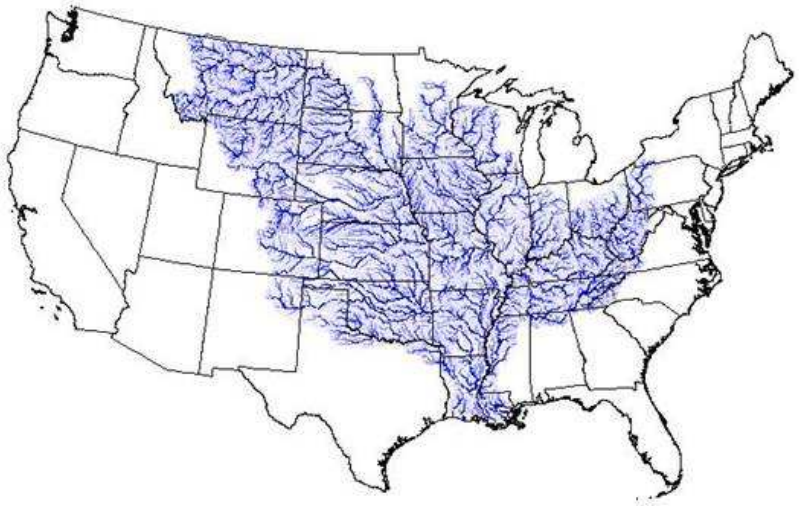
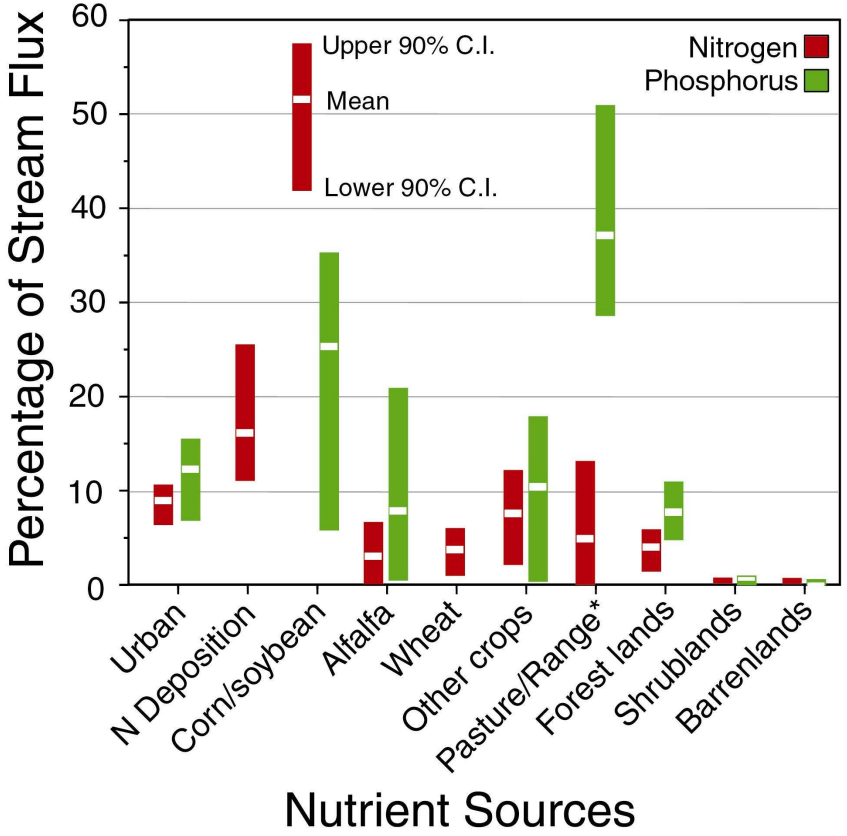
Agriculture is the predominant nutrient source; however, N and P are affected by different agricultural land uses and transport processes

Mississippi/Atchafalaya River Basin



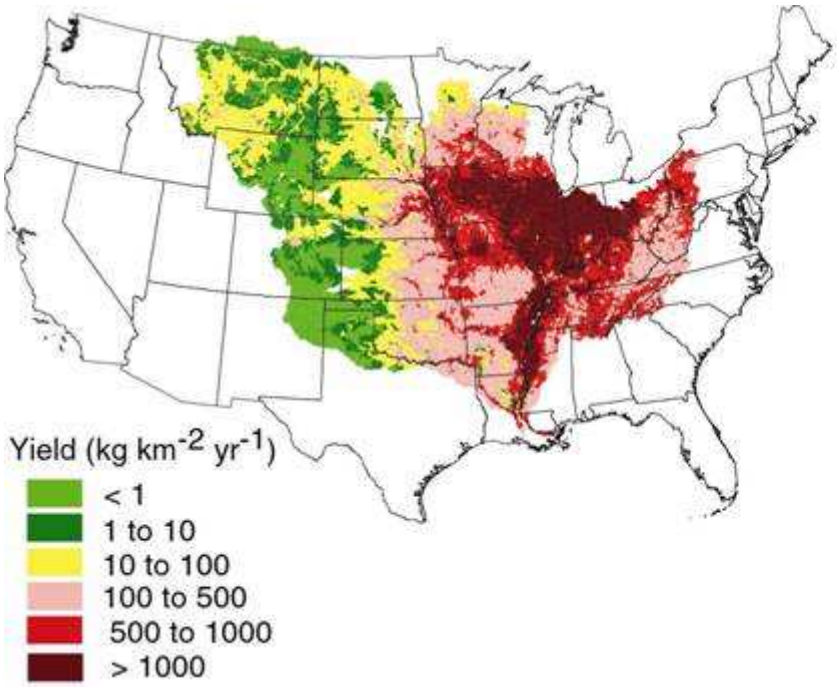
Nutrients Delivered to the Gulf



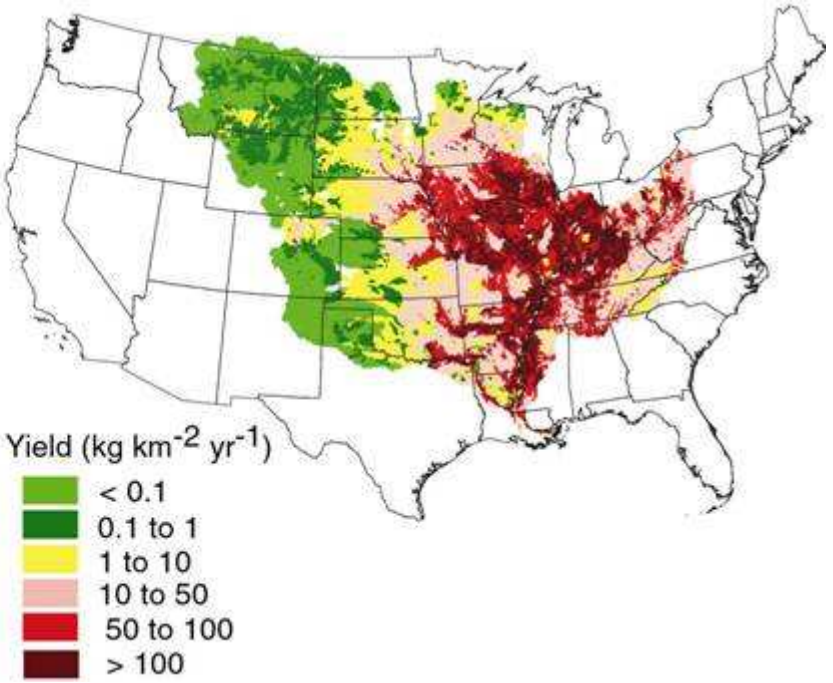
**Non-recoverable animal manure*

Nutrients delivered to the Gulf of Mexico originate primarily from Midwestern and Eastern watersheds

Nitrogen



Phosphorus



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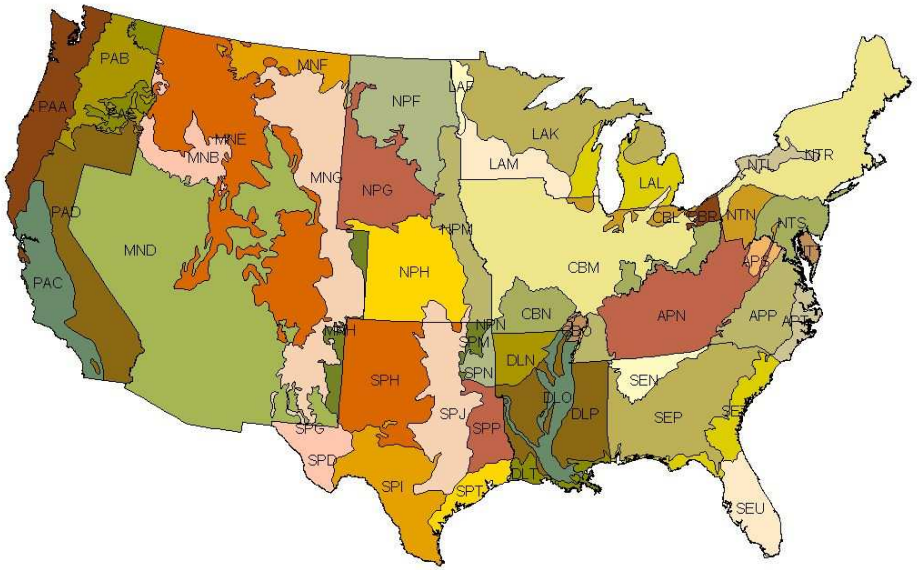
Assessment of Effects of Corn-Based Ethanol Production on Stream Nutrients, 2002-2016

USDA/ERS REAP Model

Agricultural Production Regions

S. Malcolm, ERS



REAP Documentation:
http://www.ers.usda.gov/Publications/TB1916/

- Static, general equilibrium model of agricultural production, consumption, processing, and prices; accounts for market and resource constraints
- Includes 10 crop and 13 livestock types in 45 production regions
- Determines land use, crop mix, rotations, tillage practices, and fertilizer rates
- Relies on 10-year USDA baseline projections
- SPARROW simulates effects of changes in crop acreage and production on stream load, concentration, and coastal delivery, nationally

Assessment of Effects of Corn-Based Ethanol Production on Stream Nutrients, 2002-2016

- **Ethanol / biodiesel production scenarios based on prior runs of REAP (May, 2007):**
  - Ethanol from corn - 15-20 BGal. by 2016
  - Biodiesel from soybean oil – 1 BGal. by 2016
  - CRP fixed and allowed to vary
- **Downscaling REAP predictions from 45 production regions to counties and watersheds will include measures of:**
  - Ethanol plant intensity
  - Proposed ethanol plant production
- **Results presented Dec. 2007 (American Geophysical Union Conference)**

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