What amount of nutrients are entering and leaving Kentucky?
Partnership

USGS

Governor’s Office of Agricultural Policy

KADF
KENTUCKY AGRICULTURAL DEVELOPMENT FUND
The Nutrients Issue
The Nutrients Issue

- USGS SPARROW model
- Kentucky listed as one of nine states with the largest nutrient delivery to the Gulf
- Only 52 Kentucky sites met minimum criteria for including in model
  - Few monitoring sites in western Kentucky
  - Several western Kentucky basins ranked in Top 150 basins for TN & TP yields
The Nutrients Issue

- NRCS—Mississippi River Basin Healthy Watersheds Initiative (MRBI)
Project Goal

- Bracket concentrations and loads of nutrients transported into and discharged from the Ohio River along the Kentucky border.
Project Objectives

- Measure nutrient concentrations and streamflow to estimate loads and yields
  - Ohio River at Greenup, KY—incoming
  - Ohio River at Olmsted, IL—outgoing
  - Green River at Spottsville, KY—outgoing from highly agricultural area in western part of Kentucky

- Establish a new real-time streamflow and water-quality station in the Lower Green River Basin
Site Location

USGS and GOAP monitoring sites
USGS NASQAN monitoring sites
Definitions

- **Load**: Amount of constituent (mass) that passes a given point on the river over a given time
  - Streamflow (discharge) MULTIPLIED BY nutrient concentration in streamwater

- **Yield**: Load per unit basin drainage area
  - Nutrient load DIVIDED BY basin area
  - When making comparisons among basins, yield is more useful than loads, because the influence of the basin area is removed.
Load Estimations

- USGS Load Estimator (LOADEST)
  - Calibration data
    - Continuous streamflow and
    - Nutrient concentrations
  - 7-parameter regression model
  - Calculate daily loads
  - Aggregate into annual loads
Schematic of the Ohio River Basin
USGS NASQAN and GOAP sampling sites

- Olmsted, IL
- New Harmony, IN
- Paducah, KY
- Spottsville, KY
- Cannelton, IN
- Greenup, KY
## Nitrite plus Nitrate Loads—Preliminary Findings

<table>
<thead>
<tr>
<th>Site ID</th>
<th>Site name</th>
<th>Drainage area (km²)</th>
<th>Average flow (m³/s)</th>
<th>LOADEST AMLE Predicted Flux</th>
<th>LOADEST AMLE 95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>03216600</td>
<td>Ohio River at Greenup, KY <em>(incoming)</em></td>
<td>161,000</td>
<td>2,810</td>
<td>64,100</td>
<td>58,600 - 70,000</td>
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<tr>
<td>03321500</td>
<td>Green River at Spottsville, KY¹</td>
<td>23,778</td>
<td>425</td>
<td>15,800</td>
<td>9,100 - 19,500</td>
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<tr>
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<td>Tennessee River nr Paducah, KY²</td>
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<td>2,420</td>
<td>28,600</td>
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<td>03378500</td>
<td>Wabash River at New Harmony, IN²</td>
<td>75,716</td>
<td>952</td>
<td>110,000</td>
<td>75,800 - 154,000</td>
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<tr>
<td>03612500</td>
<td>Ohio River near Grand Chain (Olmsted), IL <em>(outgoing)</em></td>
<td>526,000</td>
<td>8,930</td>
<td>314,000</td>
<td>287,000 - 343,000</td>
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</tbody>
</table>
Nitrite plus Nitrate Yields—Preliminary Findings

[Bar chart showing yields for various locations along rivers, including Ohio River mainstem, Ohio River tributaries, Mississippi River mainstem, and Mississippi River tributaries.]
## Total Phosphorus Loads—Preliminary Findings

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<td>47,000</td>
<td>42,600 51,800</td>
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Total Phosphorus Yields—Preliminary Findings

Yield, in Metric Tons/km²/year

- Ohio River mainstem
- Ohio River tributaries
- Mississippi River mainstem
- Mississippi River tributaries

Locations:
- Ohio River at Greasy, KY
- Ohio River at Campton, IN
- Green River at Spottsville, KY
- Kentucky River near Paducah, KY
- Ohio River near New Harmony, IN
- Ipava River at Vigo, IA
- Des Moines R. at Kaskaskia, IA
- Illinois R. at Vandalia, IL
- Mississippi River at Memphis, MO
- Mississippi River at Vicksburg, MS
- Mississippi River near Long Lake, MS
- Mississippi River at St. Francis, AR
- Yacoo River near Long Lake, MS
## Orthophosphorus Loads—Preliminary Findings

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<th>Site ID</th>
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<th>Average flow (m³/s)</th>
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<tr>
<td>03216600</td>
<td>Ohio River at Greenup, KY (incoming)</td>
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<td>Tennessee River nr Paduah, KY²</td>
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<td>2,420</td>
<td>3,490</td>
<td>2,770, 4,340</td>
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<td>952</td>
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<tr>
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<td>Ohio River near Grand Chain (Olmsted), IL (outgoing)</td>
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<td><strong>11,400</strong></td>
<td>10,500, 12,400</td>
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Orthophosphorus Yields—Preliminary Findings

This diagram illustrates the orthophosphorus yields from various locations in the Ohio and Mississippi River basins. The yields are measured in metric tons per square kilometer per year. The data shows significant variability across different sites, with some locations having much higher yields than others. The chart includes specific sites along the rivers, such as the Ohio River mainstem, Ohio River tributaries, Mississippi River mainstem, and Mississippi River tributaries. The USGS logo is also present, indicating the source of the data.
Real-time Nitrate Data

Green River at Spottsville, KY

CONTINUOUS STREAMFLOW AND NO₃

Daily Load

http://ky.water.usgs.gov/
Real-time data—cont.

Data-Quality Assurance

- Peak on Feb. 6, 2014
  - 3.70 mg/L

- Low on Jan. 16, 2014
  - 1.02 mg/L

[Graph showing nitrate concentrations with key events marked]
Challenges/Needs

- Decline in the # of sites with sufficient water-quality data to compute accurate annual loads
  - Prioritize
- Long-term water-quality monitoring
- Real-time continuous nitrate monitoring
- Continue collaborative approach
Thank you!

“We will be known forever by the tracks we leave.”

(American Indian Proverb)

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