Regional Assessments of Nutrient Sources, Transport, and Delivery to Streams and Coastal Areas

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Major River Basins

- 1 - New England and Mid-Atlantic
- 2 - South Atlantic-Gulf and Tennessee
- 3 - Great Lakes, Ohio, Upper Mississippi, and Souris-Red-Rainy
- 4 - Missouri
- 5 - Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
- 6 - Rio Grande, Colorado, and Great Basin
- 7 - Pacific Northwest
- 8 - California
Regional assessments of nutrient sources and transport

Objective: Build understanding of how human activities and natural features influence nutrient conditions in streams

Approach
Integrate monitoring data and watershed data within a regional model framework
Integrate USGS data with data from other Federal and state agencies
SPARROW model concepts

Preliminary model estimates of total nitrogen concentrations and yields for the southeastern U.S. for 2002

Preliminary model estimates of total nitrogen yields for the Santee River Basin and Coastal Drainages for 2002
Source areas of salinity, Southwestern U.S.

Nitrogen and phosphorus loads, Interior Low Plateau

Nitrogen and phosphorus loads, New England streams

Nitrogen loading to Chesapeake Bay

National and regional-scale SPARROW models

Source areas of salinity, Southwestern U.S.

Nitrogen and phosphorus loads, Interior Low Plateau

Nitrogen and phosphorus loads, New England streams

Nitrogen loading to Chesapeake Bay
**SPARROW** Model Concept

- **Sources**
- **Instream transport**
- **Land-to-water transport**
- **Monitored load**

*SPA*\text{tially} \textbf{R}eferenced \textbf{R}egression \textbf{O}n \textbf{W}atershed Attributes

\text{USGS}
SPARROW Model Framework

Monitoring Data
- 782 Sites

Model Predictions
- 8,092 Stream Reaches

Spatial Data Layers
- Atmospheric deposition
- NADP – 33 sites
- Fertilizer applied to farmland
- 2002 County Est.
- Precipitation
- Depth to bedrock
- STATSGO
Estimates of mean annual nutrient load at 782 sites for 2002

USGS sites: 196
State, other federal agencies: 586 (matched to USGS gage)
“Shakedown” of monitoring data for load estimation

- Nutrient data retained for 21,500 stream sites
- 3,400 sites with sufficient record (Quarterly with minimum of 20 samples)

Estimate nutrient load: 782 sites
Insufficient streamflow record: 794 sites
No gage nearby: 1824 sites
Sources accounting for instream nitrogen load

- Atmospheric deposition: 59%
- Fertilizer applied to farmland: 18%
- Animal waste: 11%
- Impervious surface area: 8%
- Point-source discharge: 4%

% contribution to instream load, average for region
Factors controlling transport of nitrogen

- Soil permeability
- Depth to bedrock
- Annual precipitation

**Land to water transport**

**Instream transport**

- Instream time of travel
- Reservoir residence time

[Diagram showing the flow of nitrogen from sources, through land-to-water transport, and instream transport, ending with monitored load.]
Legend

sep08_predictions
predictions_modelB$.IncYld_kgha

1.178348 - 2.700000
2.700001 - 3.820000
3.820001 - 5.420000
5.420001 - 7.650000
7.650001 - 14572.000000

Preliminary Total Nitrogen yields, kg/ha
SPARROW model results support resource management decisions

Preliminary model – 2002 estimated mean annual concentration for individual reaches, in mg/L

<table>
<thead>
<tr>
<th>Source</th>
<th>Concentration</th>
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<tbody>
<tr>
<td>Point-source discharge</td>
<td>0.2 mg/L</td>
</tr>
<tr>
<td>Impervious surface area</td>
<td>0.4 mg/L</td>
</tr>
<tr>
<td>Fertilizer, agricultural land</td>
<td>0.8 mg/L</td>
</tr>
<tr>
<td>Atmospheric Deposition</td>
<td>1.7 mg/L</td>
</tr>
</tbody>
</table>

Nolichucky R., 1.7 mg/L
Model results indicate areas contributing greatest amounts of nitrogen to estuary.
Preliminary yield and source shares of total nitrogen delivered to South Atlantic Estuaries

- Runoff from urban land
- Point-source discharge
- Atmospheric deposition
- Fertilizer
- Animal Waste

Nitrogen delivered to estuary from upstream sources, kg/ha/yr

- Savannah
- Charleston
- Santee
- Cape Fear
- New River
- Trent-Neuse
- Pungo-Tar
- Albemarle
Santee River Basin and Coastal Drainages—Incremental Yields

Preliminary Total Nitrogen Yields, in kg/ha

- 1.32 – 2.30
- 2.31 – 2.88
- 2.89 – 3.86
- 3.87 – 5.19
- > 5.20
Santee River Basin and Coastal Drainages—Delivered Yields

Preliminary Total Nitrogen Yields, in kg/ha

- 0.31 – 1.08
- 1.09 – 1.53
- 1.54 – 2.18
- 2.19 – 2.97
- > 2.98
Total Nitrogen Inputs

- Animals
- Fertilizer
- Urban
- Point Source
- Atmosphere

Nitrogen, in kilograms
Total Nitrogen Delivered to Stream Edge

- Animals
- Fertilizer
- Urban
- Point Source
- Atmosphere

Nitrogen, in kilograms

USGS
Total Nitrogen Transported to Estuary

- Atmosphere
- Fertilizer
- Urban
- Point Source
- Animals

Nitrogen, in kilograms

Total Nitrogen Inputs

Total Nitrogen Delivered to Stream Edge

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