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

Mike Woodside
USGS National Water-Quality Assessment Program

NAWQA Cycle II study units

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

Major River Basins
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.
Presentation Outline

- 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

USGS
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

*SPAtially Referenced Regression On Watershed Attributes

Sources

Land-to-water transport

Instream transport

Monitored load
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
- Fertilizer applied to farmland
- Animal waste
- Impervious surface area
- Point-source discharge

% contribution to instream load, average for region:
- Atmospheric deposition: 59%
- Fertilizer applied to farmland: 18%
- Animal waste: 11%
- Impervious surface area: 8%
- Point-source discharge: 4%
## Factors controlling transport of nitrogen

### Land to water transport
- Soil permeability
- Depth to bedrock
- Annual precipitation

### Instream transport
- Instream time of travel
- Reservoir residence time

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**Sources**

**Land-to-water transport**

**Instream transport**

**Monitored load**
SPARROW model results support resource management decisions

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

- Nolichucky R., 1.7 mg/L

- Atmospheric Deposition: 0.8 mg/L
- Impervious surface area: 0.4 mg/L
- Animal waste: 0.2 mg/L

- Point-source discharge: 0.2 mg/L
- Fertilizer, agricultural land: 1.7 mg/L

- < 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- > 1.5
Model results indicate areas contributing greatest amounts of nitrogen to estuary.

Preliminary

Yield (2002) delivered to estuary from watershed, kg/yr/km²

- Blue: < 200
- Green: 200 - 400
- Yellow: 400 - 800
- Red: > 800
Preliminary yield and source shares of total nitrogen delivered to South Atlantic Estuaries

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

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

Species:
- Savannah
- Charleston
- Santee
- Cape Fear
- New River
- Trent-Neuse
- Pungo-Tar
- Albemarle

USGS
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 Delivered to Stream Edge

- **Animals**: 30,000,000 kg
- **Fertilizer**: 40,000,000 kg
- **Urban**: 5,000,000 kg
- **Point Source**: 5,000,000 kg
- **Atmosphere**: 10,000,000 kg

**Total Nitrogen Inputs**: 100,000,000 kg
Total Nitrogen Transported to Estuary

- Atmosphere
- Urban
- Point Source
- Fertilizer
- Animals

Total Nitrogen Inputs
Total Nitrogen Delivered to Stream Edge

Nitrogen, in kilograms
氮运输至河口总氮量

USGS
Contact Information


Mike Woodside
NAWQA Regional Coordinator
mdwoodsi@usgs.gov

Anne Hoos
TN Water Science Center
abhoos@usgs.gov

Ana Garcia
NC Water Science Center
agarcia@usgs.gov

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