North American Nitrogen Center

- One of 5 continental-scale centers of new International Nitrogen Initiative established by the International Council of Science (ICSU, through IGBP and SCOPE).
- We are just getting started…. Hope to make Susquehanna River basin one prime focus.

NRC 2000:

Nitrogen is now the largest pollution problem in the coastal waters of the United States.

Two thirds of coastal rivers and bays are moderately to severely degraded from nitrogen pollution.

“Dead zones,” or hypoxic areas – major global problem (UNEP, March 2004)
Other consequences of accelerated N cycle

- **N\textsubscript{2}O**: greenhouse gas; catalyzes stratospheric ozone destruction; residence time of 120 years.
- **Ecological effects**: eutrophication in tropical lakes; acidification of sensitive freshwaters; ozone damage to forests and agricultural productivity; cation loss from forests with resulting loss of productivity; reduced biodiversity
- **Health effects**: blue-baby syndrome; carcinogenic risk from nitrate in drinking water; perhaps attention-span disorder; pulmonary and carcinogenic risk from fine particles; toxics from harmful algal blooms; increase in allergies from pollen and molds; perhaps increased cholera risk; perhaps increased risk of malaria, West Nile fever, and other diseases whose vectors increase with N fertilization

Human activity has roughly doubled formation of reactive N on continents....

But with exception of N\textsubscript{2}O, reactive nitrogen cycles at regional and smaller scales, not globally.

1993 nitrogen deposition, kg/km\textsuperscript{2}/yr

Increase in nitrogen flux in rivers due to human activities for key contrasting regions of the world:

- Labrador & Hudson’s Bay: No change
- Southwestern Europe: 3.7-fold
- Great Lakes/ St. Lawrence basin: 4.1-fold
- Baltic Sea watersheds: 5.0-fold
- Mississippi River basin: 5.7-fold
- Yellow River basin: 10-fold
- Northeastern US: 11-fold
- North Sea watersheds: 15-fold
- Republic of Korea: 17-fold
  - (Susquehanna River basin ~9-fold)


North American Nitrogen Center and the US....

- Highest rate of NO\textsubscript{x} emissions per capita in the world.
- Highest rate of inorganic N fertilizer use per capita in the world.
- Second highest rate of meat consumption per capita in the world.

Can we start to solve the nitrogen problem in the US? If so, can our solutions work elsewhere?

Sources of Nitrogen Pollution to Coastal Rivers and Bays in the US on Average

- Runoff in water from agriculture 44%
- Wastewater 16%
- Atmospheric Deposition 40%
- Burning Fossil Fuels 30%
- Ammonia flux through atmosphere from agriculture 10%
Goals of the North American Nitrogen Center:

- To better assess sources of N and the drivers of change in N cycling across the regions of North America, with an emphasis on trends in fluxes and environmental exposure.
- To comprehensively and quantitatively assess both the ecological and human-health consequences of N pollution in North America.
- To develop policy options for reducing N pollution and to encourage large-scale pilot studies to test potential policies and technical solutions.
- To communicate the issues of human acceleration of the N cycle to the public and to decision makers, and to facilitate communication and interaction among the scientific community.

Hope to make Susquehanna River basin a prime focal site!