Agriculture and Nitrogen Dynamics in the US

Mark R. Walbridge
National Program Leader, Soil & Water Resource Mgmt.
Natural Resources & Sustainable Agricultural Systems
Agricultural Research Service
U. S. Department of Agriculture
Agricultural Research Service

USDA’s chief scientific research agency:

- 1,200 research projects within 22 National Programs
- 2,100 scientists
- 6,000 other employees
- 100 research locations (including 5 outside the US)
- $1.2+ billion annual budget
ARS National Programs

ARS’ 22 National Research Programs are organized around 4 themes:

• Nutrition, Food Safety/Quality
• Animal Production and Protection
• Natural Resources and Sustainable Agricultural Systems (NRSAS)
• Crop Production and Protection
NRSAS Mission

Develop scientific knowledge and technology to ensure safe and affordable food, feed, fiber, and renewable energy supplies . . .

While enhancing the environment and quality of life for producers, rural communities, the Nation, and the world.
Natural Resources & Sustainable Agricultural Systems Research Programs

Agricultural System Competitiveness & Sustainability
From Farm to City

- Pasture
- Forage
- & Range Land Systems

Agricultural Waste
& Byproduct Utilization

Soil & Air Resource Management

- Water Availability & Watershed Management

Bioenergy
ARS Nitrogen-Related Research

- Managing N Losses in Agricultural Drainage Waters
- GRACEnet
- NLEAP Model
- N Balance in Animal Production Systems
The Conservation Effects Assessment Project (CEAP)

USDA spends $4B/yr on conservation practices to benefit the environment.

CEAP was developed to document the effects of these practices on the landscape.

Field-to-watershed scale projects use both monitoring data and model projections to estimate net cumulative impacts at the regional scale.

The model used is the Soil Water Assessment Tool (SWAT).
Choptank River Watershed Project

**Overall Goal:** Establish a watershed-scale assessment of NRCS/FSA conservation program effects.

- Monitor water quality in 15 sub-watersheds
- Evaluate the efficiency of conservation practices using water quality models and field measurements
  - Riparian buffers and CRP lands
  - Cover crops
  - Wetlands
  - Ditch management (controlled drainage)
- Develop innovative remote sensing tools to evaluate conservation practices within a complex agricultural landscape.
Remote Sensing of Cover Crop Nutrient Uptake on Maryland’s Eastern Shore

• Collaboration between USDA/ARS and MD Dept. of Agriculture (MDA)

• Objective: Evaluate the effects of cover crop implementation on N uptake in the Choptank watershed

• Method: Combines farm program information, remote sensing, and on-farm research

• Outcomes: Real-time measurements of cover crop effectiveness on all farms that enroll in the cost share programs
Calculating cover crop nutrient uptake

1. Identify fields and practices

2. Collect satellite imagery

3. Field-sample a few farms for calibration

4. Calibrate vegetation index

5. Calculate biomass on all fields
Calculating cover crop nutrient uptake

Biomass (estimated from satellite imagery) × Nutrient content (estimated from sampling) = Nutrient uptake

48,400 lb N uptake on 6300 acres of cover crops planted within the Choptank River study area (2005)

6. Summarize results

Hulless barley also provides ethanol bioenergy
Monitoring Wetland Hydrology in the Choptank Watershed
Source Areas of N to the Gulf of Mexico

EXPLANATION
Yield, in kilograms per square kilometer per year
- Less than 200
- 201 to 500
- 501 to 1,000
- 1,001 to 1,800
- 1,801 to 3,050

Figure 6. (A) Nitrogen inputs during 1992 and (B) average annual nitrogen yields of streams for 1980–96 (modified from Goolsby and others, 1999).