LPE Webcast in N leaching to Groundwater
May, 2012

Nitrate Issues with Land Application in the Southeast US.

What are the Primary Water Quality Contaminants in Manure?

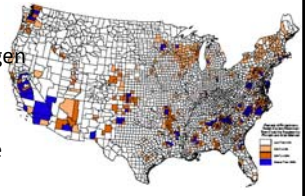
Pollutant	Risk to:	Common Path
Nitrate	Human/Animal Health	Leaching to Groundwater
Ammonia	Fish Kills	Surface Runoff
P	Eutrophication	Erosion/Surface Runoff
Pathogens	Human Health	Surface Runoff
Organic Matter	Reduced oxygen-fish kills	Surface Runoff

From: Livestock and Poultry Environmental Curriculum

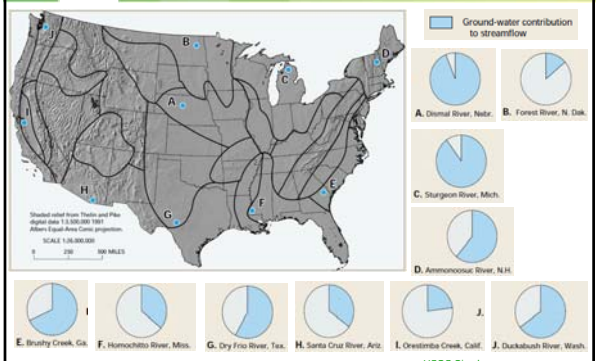
N Losses

Nitrogen in water impacts human health, animal health and fragile ecosystems.

- Ammonia volatilization
- Emissions of nitrogen gases
- Runoff on surface
- Leaching of Nitrate



Groundwater Contributions to Stream Flow



USGS Circular 1139

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Nitrate Contributions from Stream Base Flow

USGS Scientific Investigations Report 2010-5098

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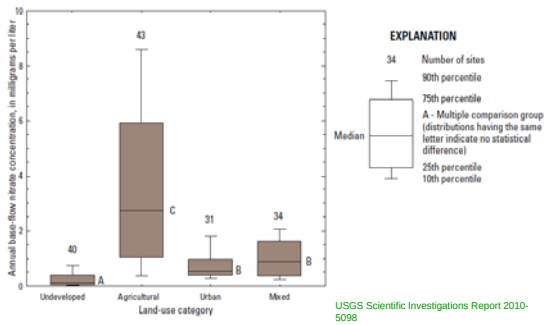
Distribution of Base Flow Nitrate Concentrations by land Use



USGS Scientific Investigations Report 2010-5098

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The archived presentation is available at:
http://www.extension.org/pages/21819/chronological-webcast-archive

Nitrogen Efficiency in Land Application

- N is a valuable input but worldwide N use efficiency is estimated around 50%.
- Clearly, both food production and the environment could be improved through better utilization.
- Even though P is getting considerable attention currently, N is clearly the critical design nutrient in most systems.

Nutrient Availability

- Available Nitrogen = inorganic and organic N.
  - Inorganic N is relatively easy to measure, however losses are difficult to quantify or estimate.
  - Availability factors range from 0.1 to 0.95.
  - Mineralizable N is difficult to measure and has just as much variability.
- To manage land application systems, knowledge of both relative amounts and availability over time are needed.

Case Studies

Herrings Marsh Run, NC

- Coastal Plain Soils, 1991-1996
- 84 shallow wells on 21 farms, 15 row crops, swine, cattle, litter
- 74% less than 10 ppm nitrate, 19% 10-20 ppm, 7% above 20 ppm
- High values all on four farms
  - Worst on Swine farm with overloaded spray field, improved with NMP implementation
  - Swine effluent on grass 46 ppm
  - Row Crops 7 ppm
  - Pastures 3 ppm

Stone et al., 1998. Trans ASABE 41(1):59-64

Lower Sawannee River Basin, FL

- Two sites, well drained sands
- Bermuda grass
- 4 rates of AN, 2 rates of litter, and mixed were surface applied
- 1998-2000 growing seasons
- Minimal leaching on all treaments except AN at the highest rates

Woodard and Sollenberger, 2011, Crop Sci 51:1342-1352

N budgets for SE fescue pasture

- Study sites in AL Coastal Plain, Georgia Piedmont, and Cumberland Plateau (TN)
- Poultry Litter applied two yrs (92-225 lbs/ac PAN)
- N fluxes measured
- 57% of N applied was not harvested

Marshall et al., 2001. Nut Cycl in Agroecosystems 59:75-83

Coastal Plain

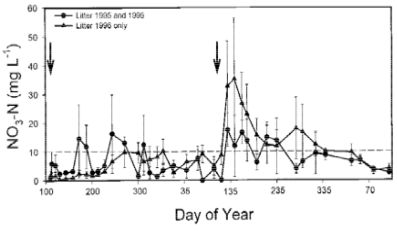
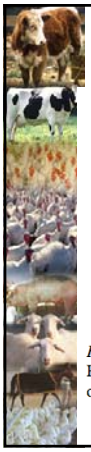


Figure 1. NO_3-N concentrations in leachate at 1-m depth at the Coastal Plain site over the course of the study. The arrows indicate time of litter application in Spring of 1995 and 1996. The dashed line represents the USEPA maximum contamination limit



Piedmont

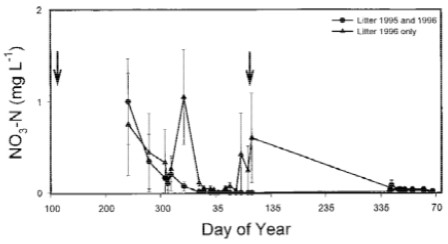


Figure 2. NO_3-N concentrations in leachate at 1-m depth at the Piedmont site over the course of the study. The arrows indicate time of litter application in Spring of 1995 and 1996.

N budgets

	Coastal Plain		Piedmont		Cumberland Plateau	
	95/96	96/97	95/96	96/97	95/96	96/97
N Inputs:	------kg ha^{-1}------					
Broiler Litter	143	103	163	150	252	202
Wet Deposition[a]	4	4	4	4	4	4
Dry Deposition[b]	2	2	2	2	2	2
Total Inputs:	149	109	169	156	258	208
N Outputs:						
NH_3 Volatilization	4	4	10	8	9	4
Denitrification	3	5	3	2	2	1
Plant Uptake	76	101	69	68	21	22
Total Outputs:	83	110	82	78	32	27
N Balance:	+66	−1	+87	+78	+226	+181

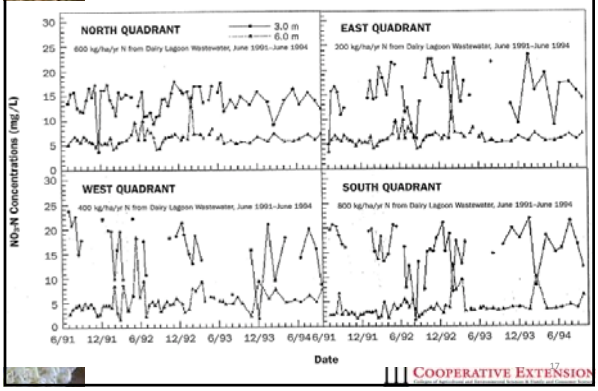
[a] wet deposition estimated from National Atmospheric Deposition Program (1995).
[b] dry deposition estimated from Hanson and Lindberg (1991).

Tifton, GA

- Sandy Coastal Plain Soil
- Liquid Dairy Manure applied through Center Pivot at 180, 360, 540, and 710 lbs N/ha/yr
- Corn Silage, Bermuda Grass, Rye rotation
- 1991-1999
- 72 wells at 3 and 6 m

Hubbard et al., 2004 JSWC 59(2):72-86

Nitrate in Groundwater



Tifton Studies

- Shallow lysimeter data showed nitrate conc decreased under 140 lb/ac treatment, stayed the same on 360 lb/ac treatment and increased under 540 and 710 lb/ac treatment
- Treatment affects not seen at 3 m or 6 m wells
- Transport through more clayey subsoils is slow.

Strategies to reduce N Losses

- Generally accepted that the best way to protect water quality is through control of the amount, timing, and location of manure application.
- Primarily accomplished through NMP's
- Need to recognize that natural systems leak, secondary BMP's may be needed.

Other management strategies

- Use multiple smaller applications
- Irrigation scheduling and timing to avoid excessive rainfall
- Incorporate N into root zone and use tillage systems to promote N use.
- Avoid applications in zones of rapid transmission or sensitive areas.

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Newer Approaches

- N-indexes or the use of crop simulation models could help to reduce N losses due to denitrification and leaching.
- These tools allow users to look at all the hydrologic, soil, climate, cropping, and management factors that influence this complex process.

Farmers
Scientists/Managers

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Thank you for listening!
Next we have Satish Gupta from
University of Minnesota
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