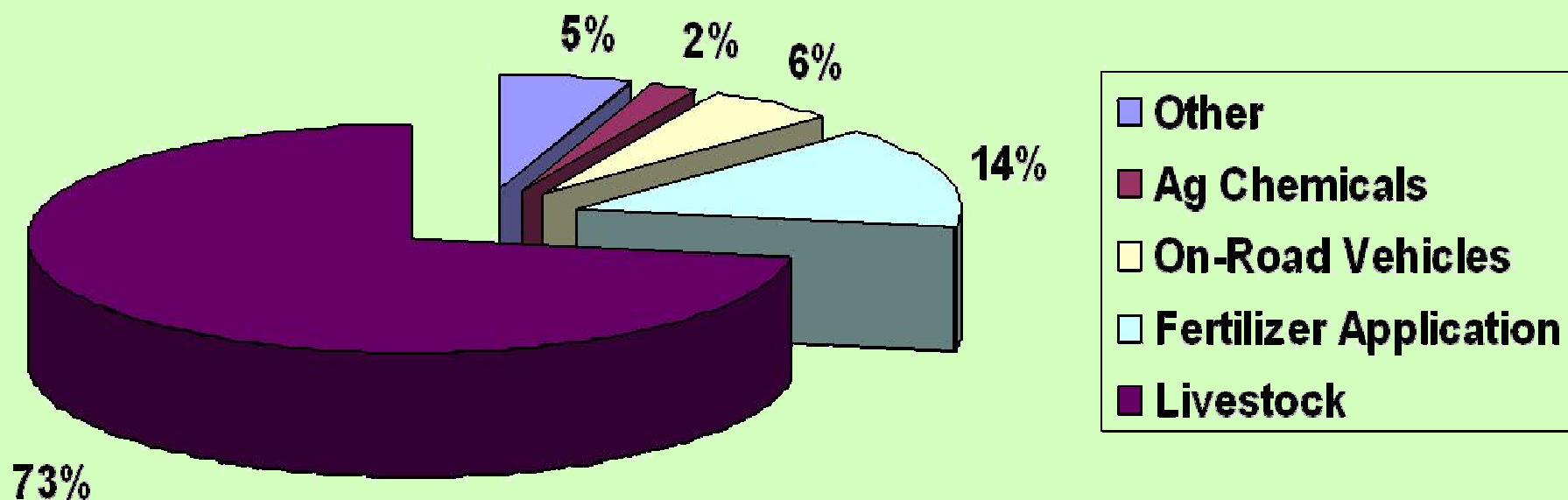# Research and Monitoring Needs from an Agricultural Perspective

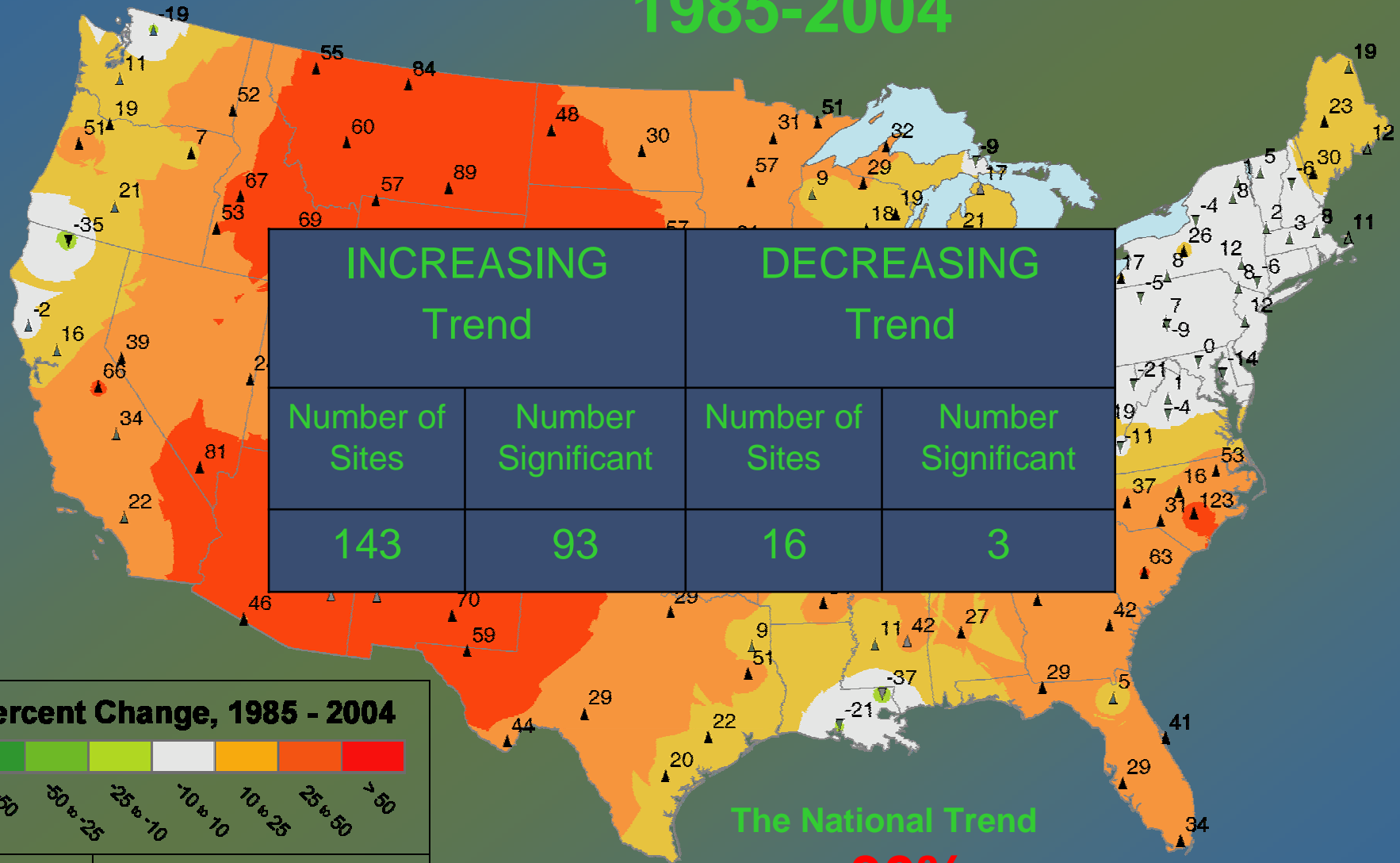**Raymond E. Knighton**

National Program Leader

USDA-CSREES

2001 Total U.S. Emissions of Ammonia
(4,998,000 short tons)

5% 2% 6% 14%

Legend:
- Other
- Ag Chemicals
- On-Road Vehicles
- Fertilizer Application
- Livestock

73%

EPA Air Pollutant Emission Trends (http://www.epa.gov/ttn/chief/trends/index.html)

NADP/NTN Ammonium Trend 1985-2004

INCREASING Trend		DECREASING Trend	
Number of Sites	Number Significant	Number of Sites	Number Significant
143	93	16	3

Percent Change, 1985 - 2004

5 to 50 | -50 to -25 | -25 to -10 | -10 to 10 | 10 to 25 | 25 to 50 | > 50

| Trend		Significance
△	Increasing	■ Significant and Homogeneous
▽	Decreasing	■ Significant, not Homogeneous
		□ Not Significant

The National Trend

+ 30%

(median change)

Research Needs & Data Gaps for N Emissions from Agriculture

- What have we learned over the last 5 years
  - Better understanding of gas and particulate matter concentrations in animal production systems
  - Better understanding of the fate and transport of gas and particulates
  - Better characterization of the diurnal and seasonal nature of gas concentrations
  - Better monitoring and measurement systems
  - Better understanding of particle size distributions
  - Better estimates of errors associated with particulate matter measurements and methods

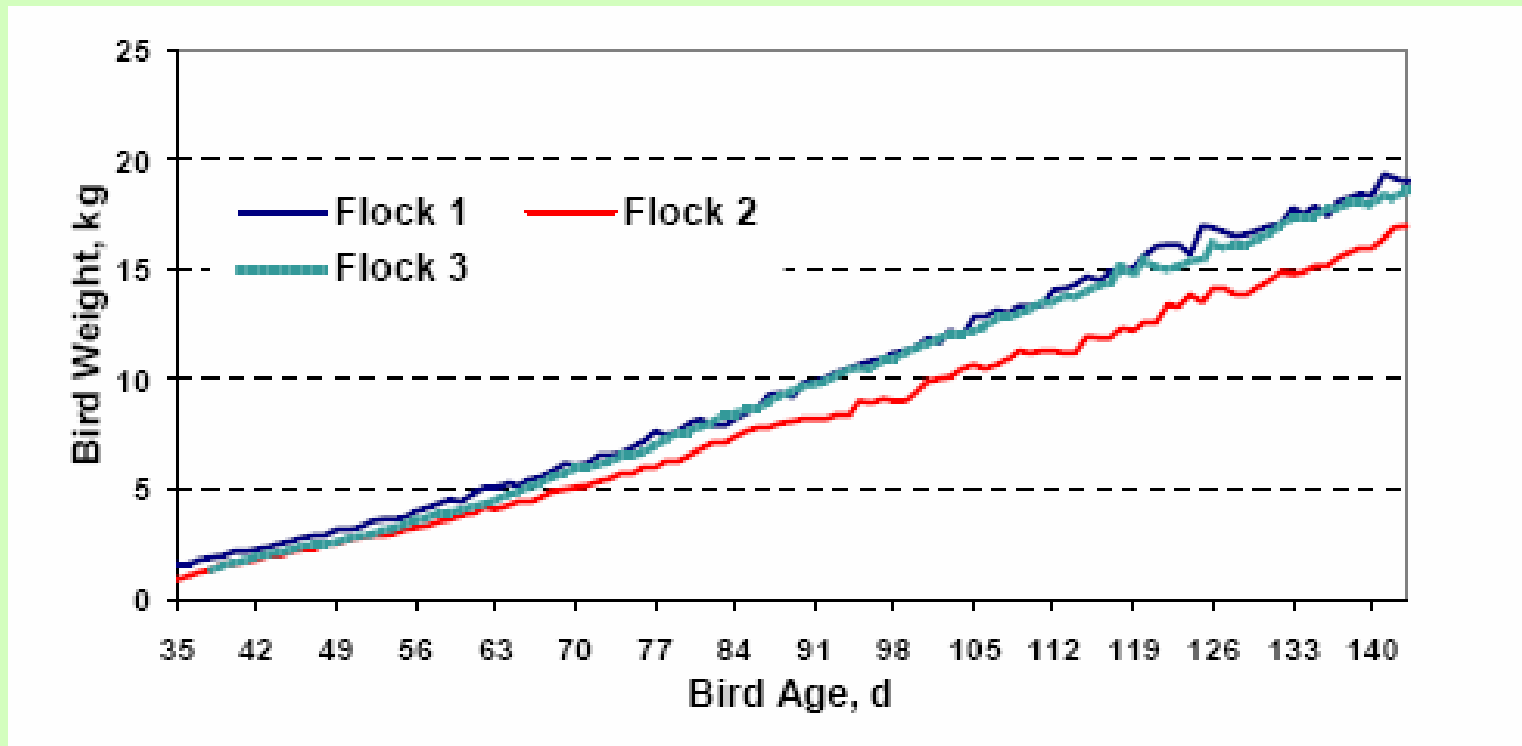# Research Needs & Data Gaps for N Emissions from Agriculture

- Are we there yet?
- What are the goals?
  - To predict an emission rate at any point in the production cycle for the whole farm.
  - To predict the fate and transport of emissions downwind.
  - To measure dry and wet deposition.
  - To validate regional and local transport models.
  - To mitigate emissions.
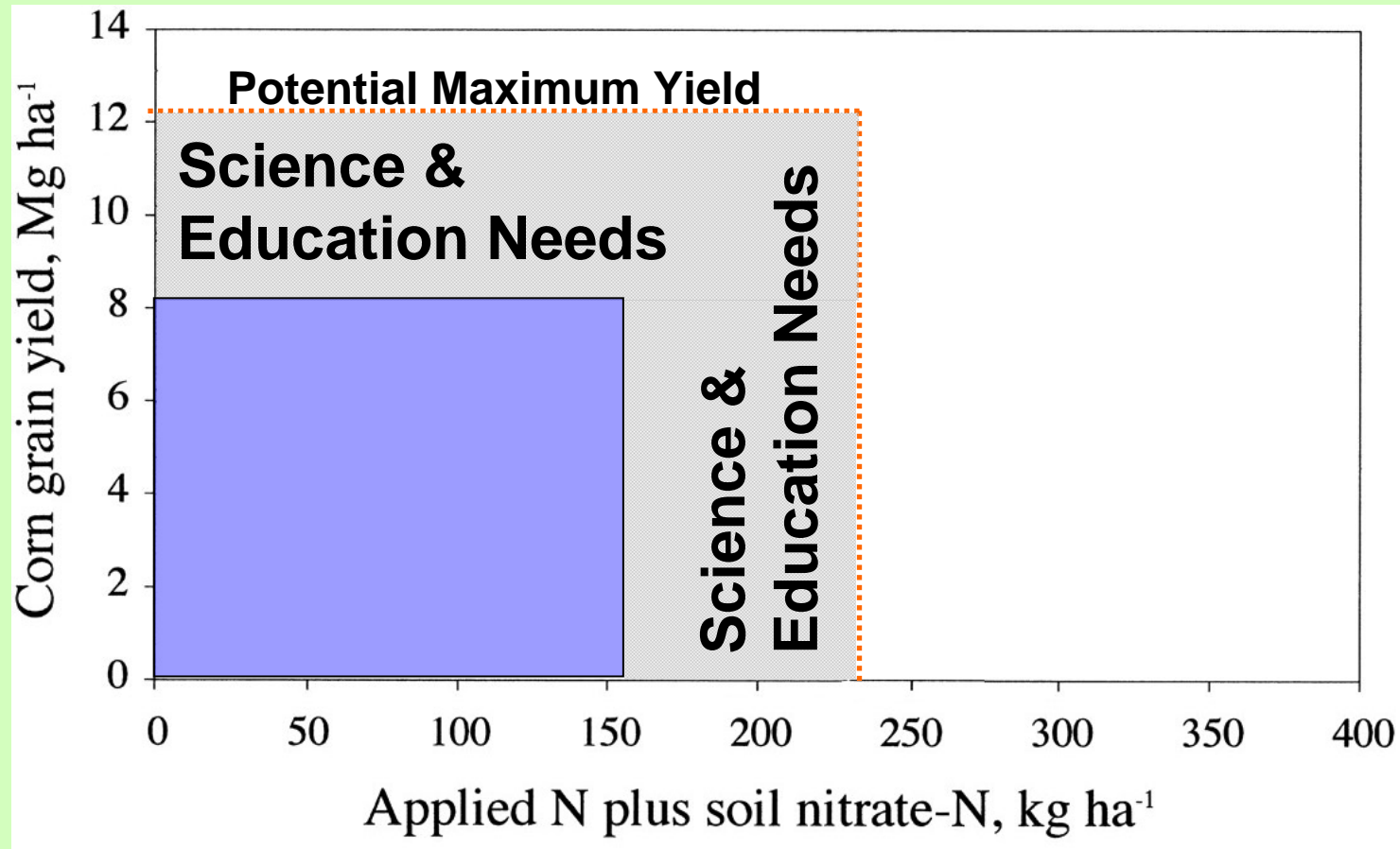
What are the science and education needs to optimize production while minimizing environmental degradation?

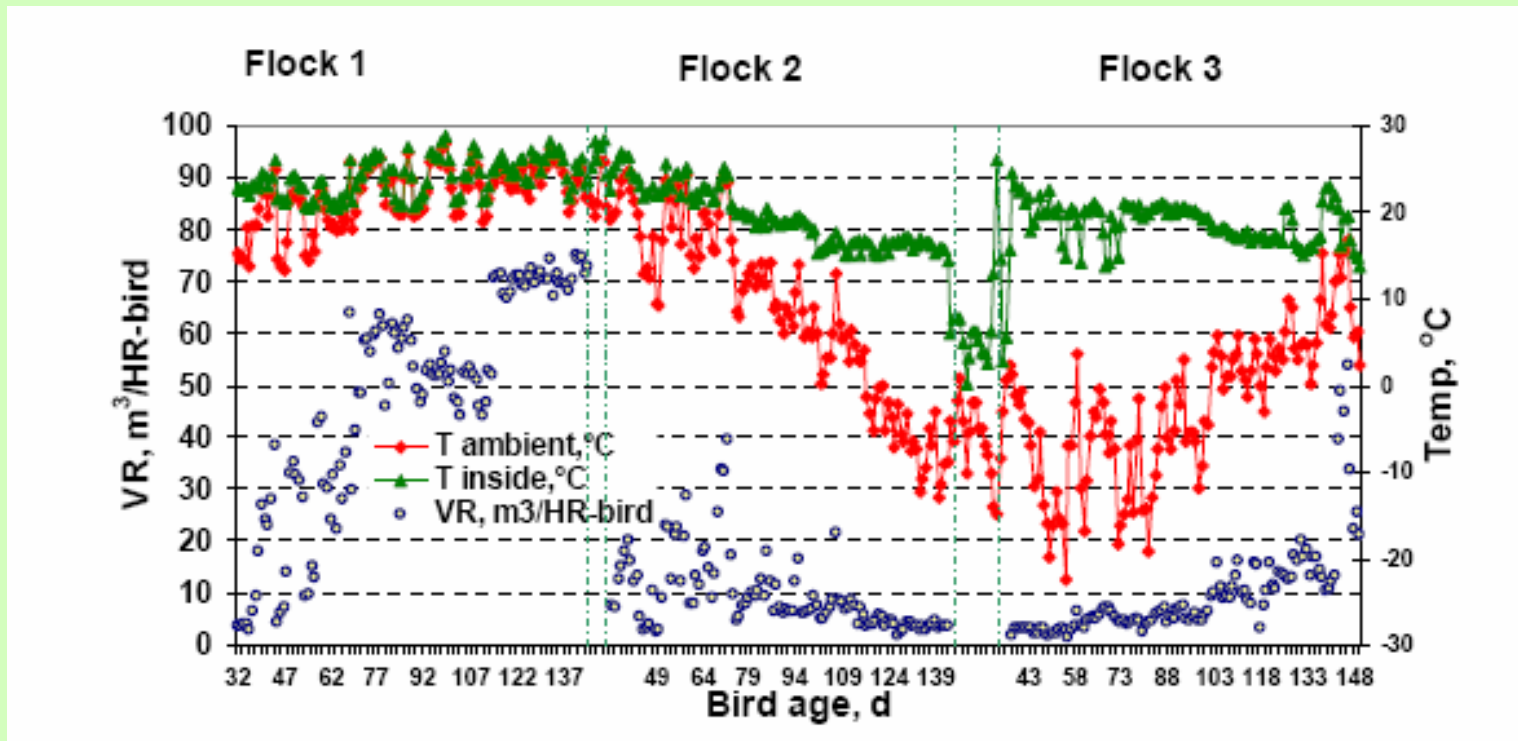# Research Needs & Data Gaps for N Emissions from Agriculture

- Well defined production systems

After Li et. al., 2008

Research Needs & Data Gaps for N Emissions from Agriculture

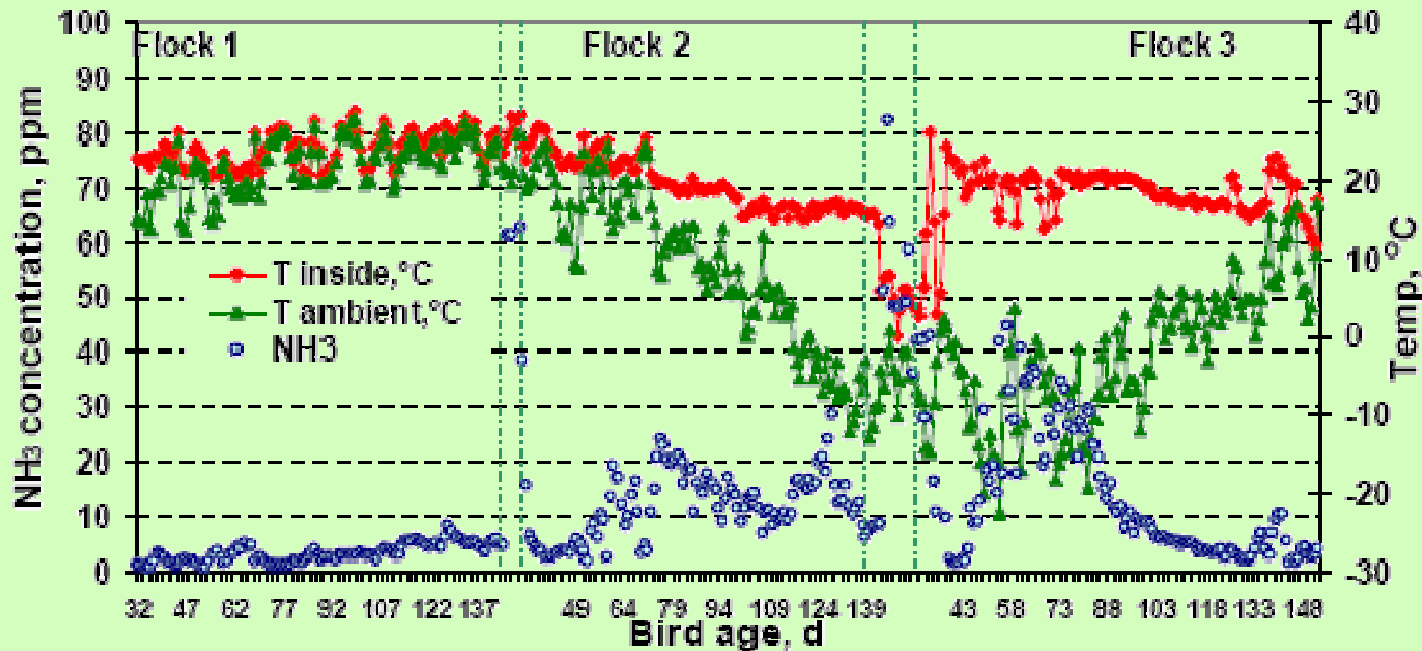- Improved monitoring and measurement systems

After Li et. al., 2008

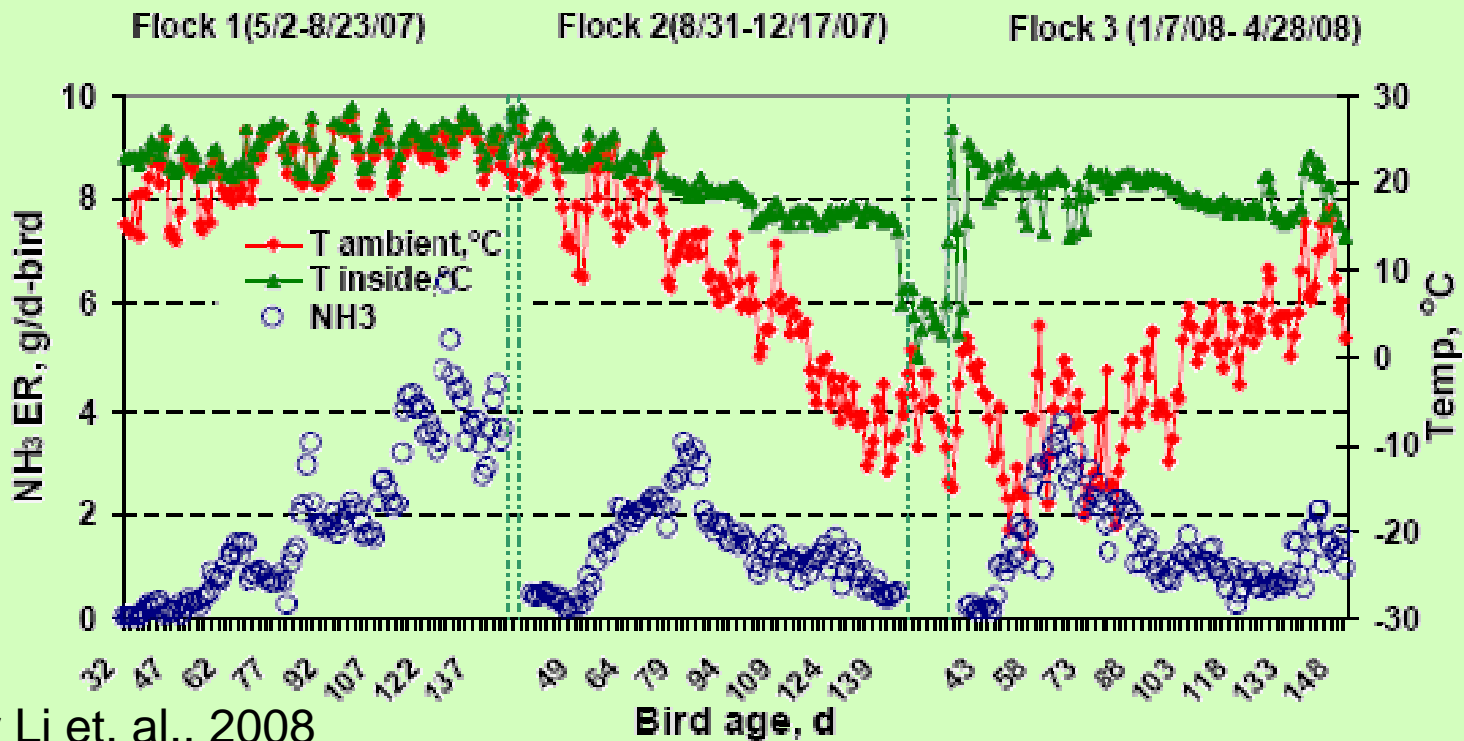# Research Needs & Data Gaps for N Emissions from Agriculture

- Need for improved continuous measurement systems for gases and particulates to describe variability and reduce uncertainty.

After Li et. al., 2008

Research Needs & Data Gaps for N Emissions from Agriculture

- Highly variable emission rates dependent on environmental variables.

- What are the critical environmental variables?

- Where do we sample?

After Li et. al., 2008

Research Needs & Data Gaps for N Emissions from Agriculture

- Poorly understood biogeochemistry of sources. What is the microbiology and chemistry occurring in the litter/manure?
  - Critical for the understanding of emissions and for controlling emissions
- Poor chemical and biological characterization of particulate matter. Measurements are mass-based.
- Poor understanding of gas-to-particle conversion of agricultural sources.
  - Need a better understanding of the atmosphere and meterology within and downwind of production facilities.

Research Needs & Data Gaps for N Emissions from Agriculture

- Improved understanding of fate and transport of emissions
  - Better understanding of processes such as entrainment, chemistry, transport, and deposition
  - Improved models to describe these processes
  - Integration of these process models into regional and global models
  - Source identification from deposition measurements for effective mitigation strategies

Future Success of NADP

- Timely, economic, or environmentally relevant data products

Questions

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http://www.csrees.usda.gov/airquality.html