Agriculture and Environmental Stewardship: Integrating Science and Policy

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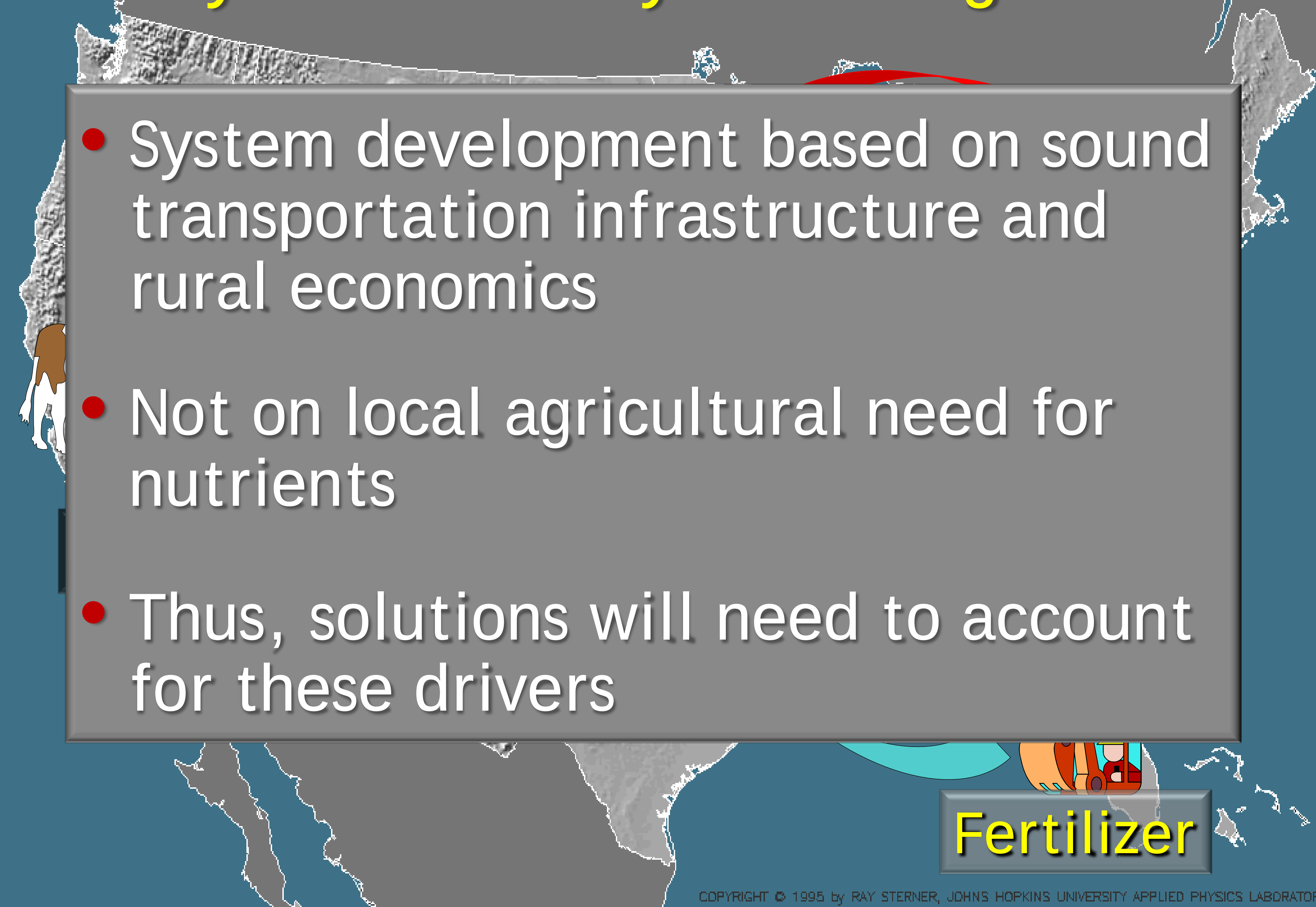
Agriculture Producing Solutions

Where are we today?

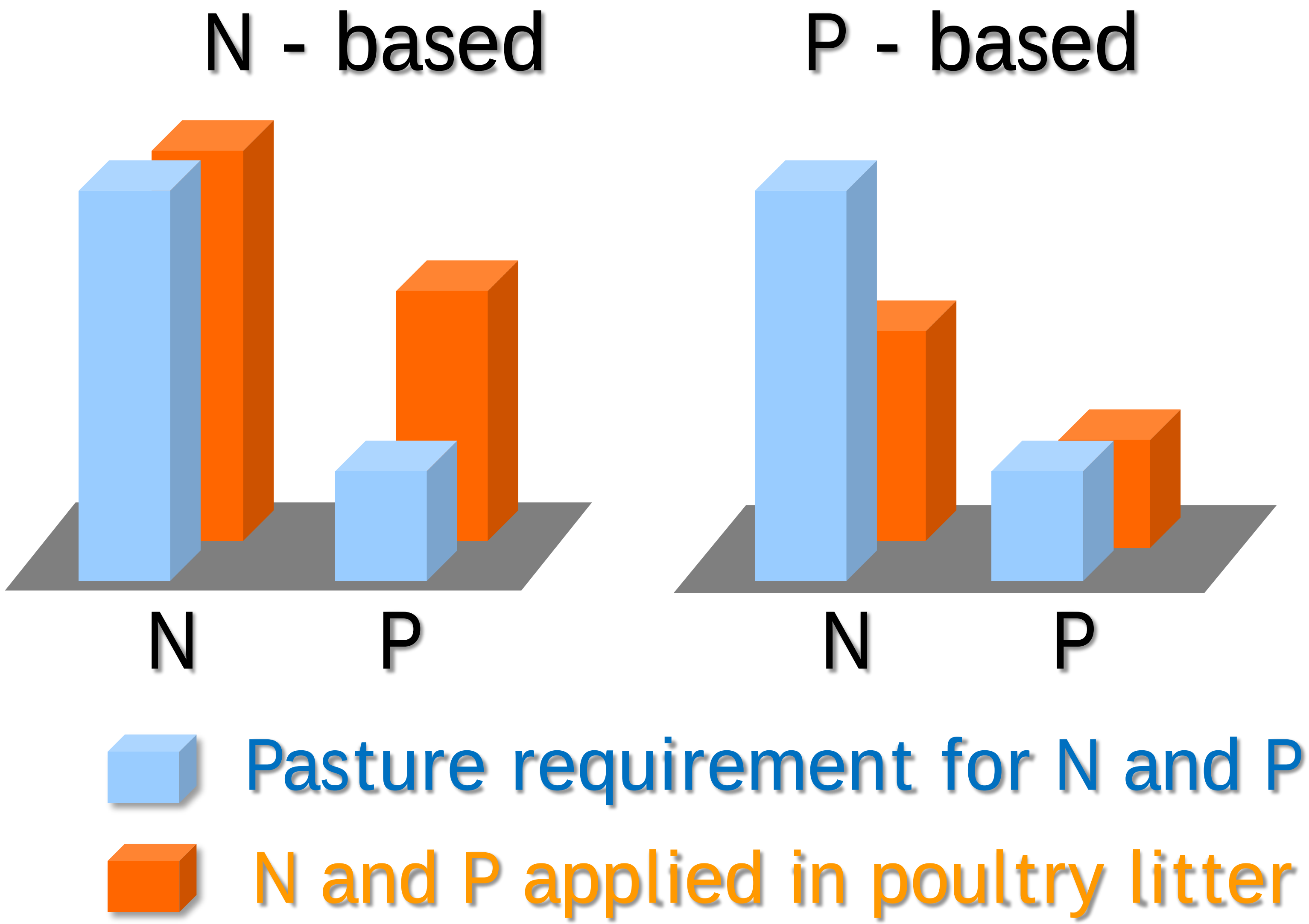
- Science responding to “issues”
  - Nutrient management planning
  - System response to management changes
  - Role of models
- Where the breakdown occurs and what we learn from the past
- How partnerships and resources play a key role in outcomes
- Thoughts for the future

Today's nutrient cycle is fragmented

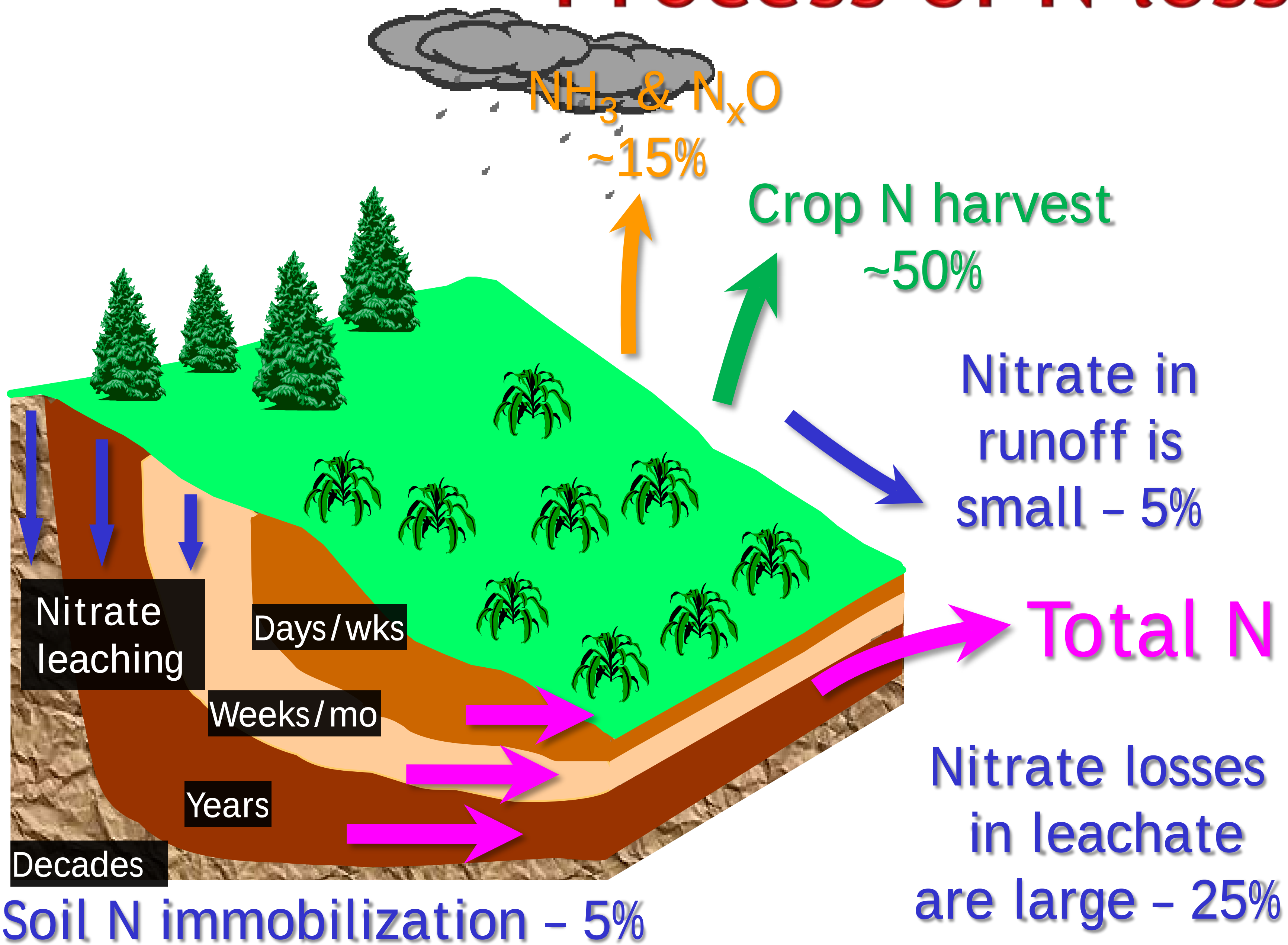
- System development based on sound transportation infrastructure and rural economics
- Not on local agricultural need for nutrients
- Thus, solutions will need to account for these drivers



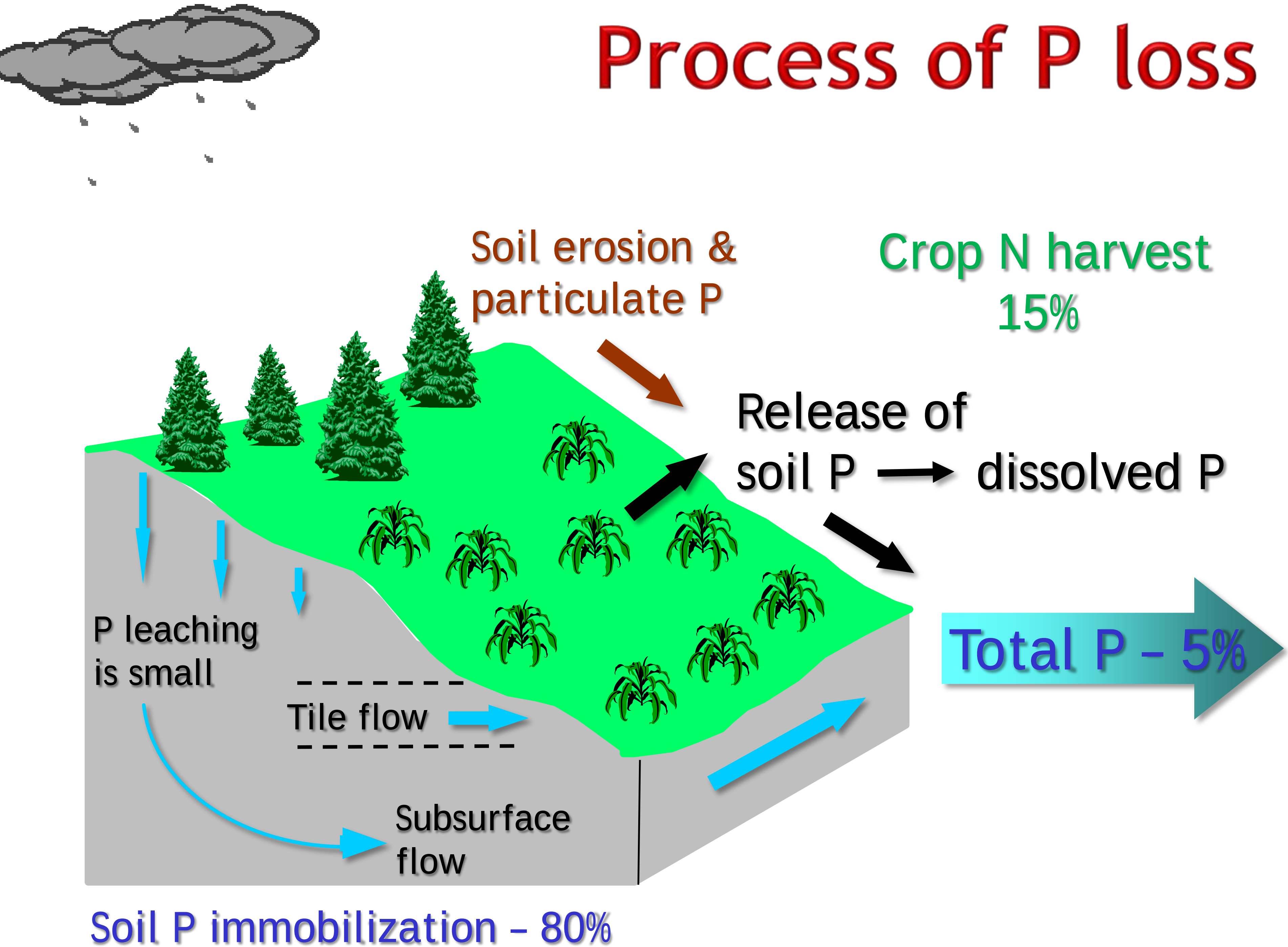
Nutrient balancing dilemma



Process of N loss

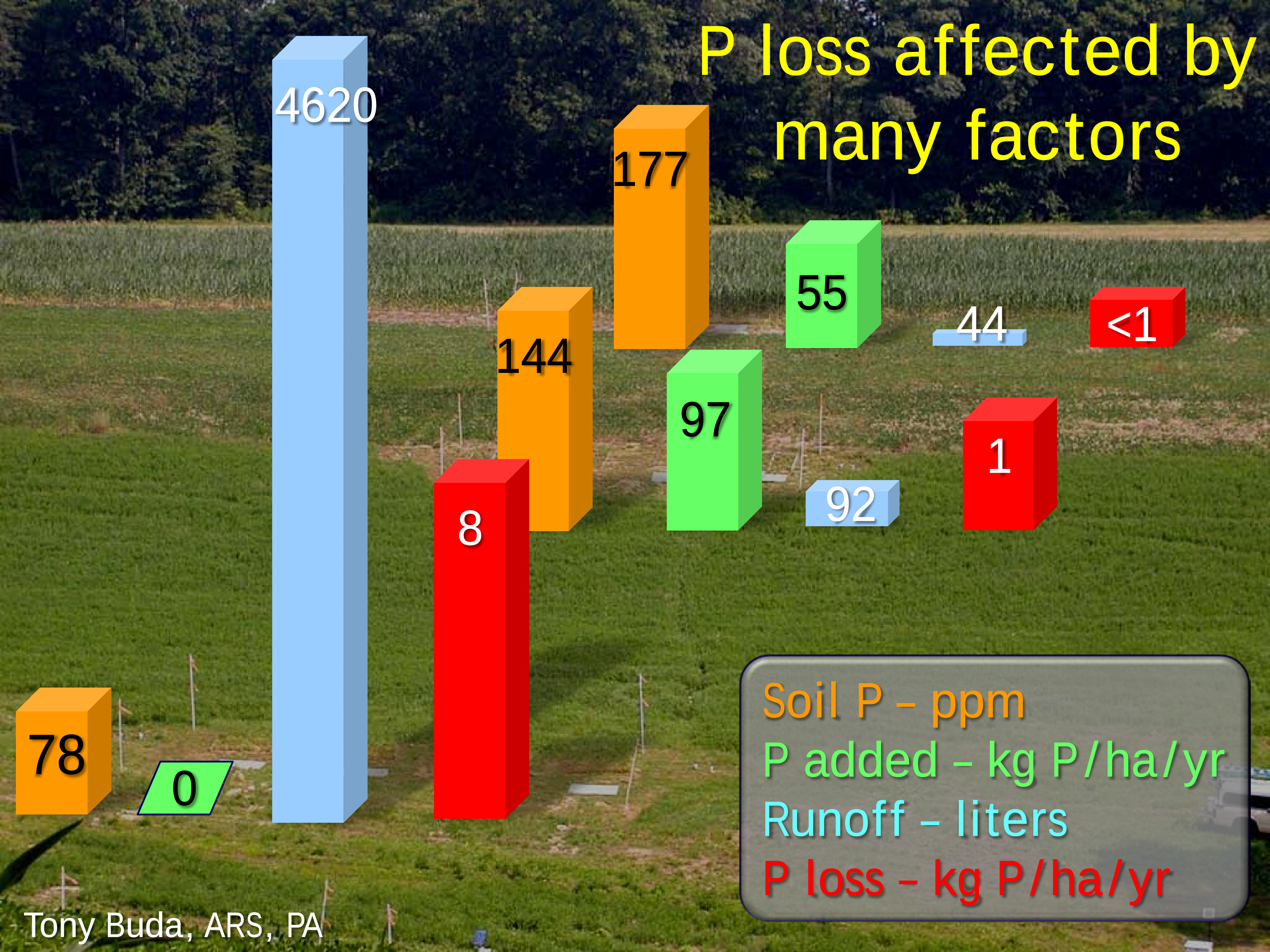


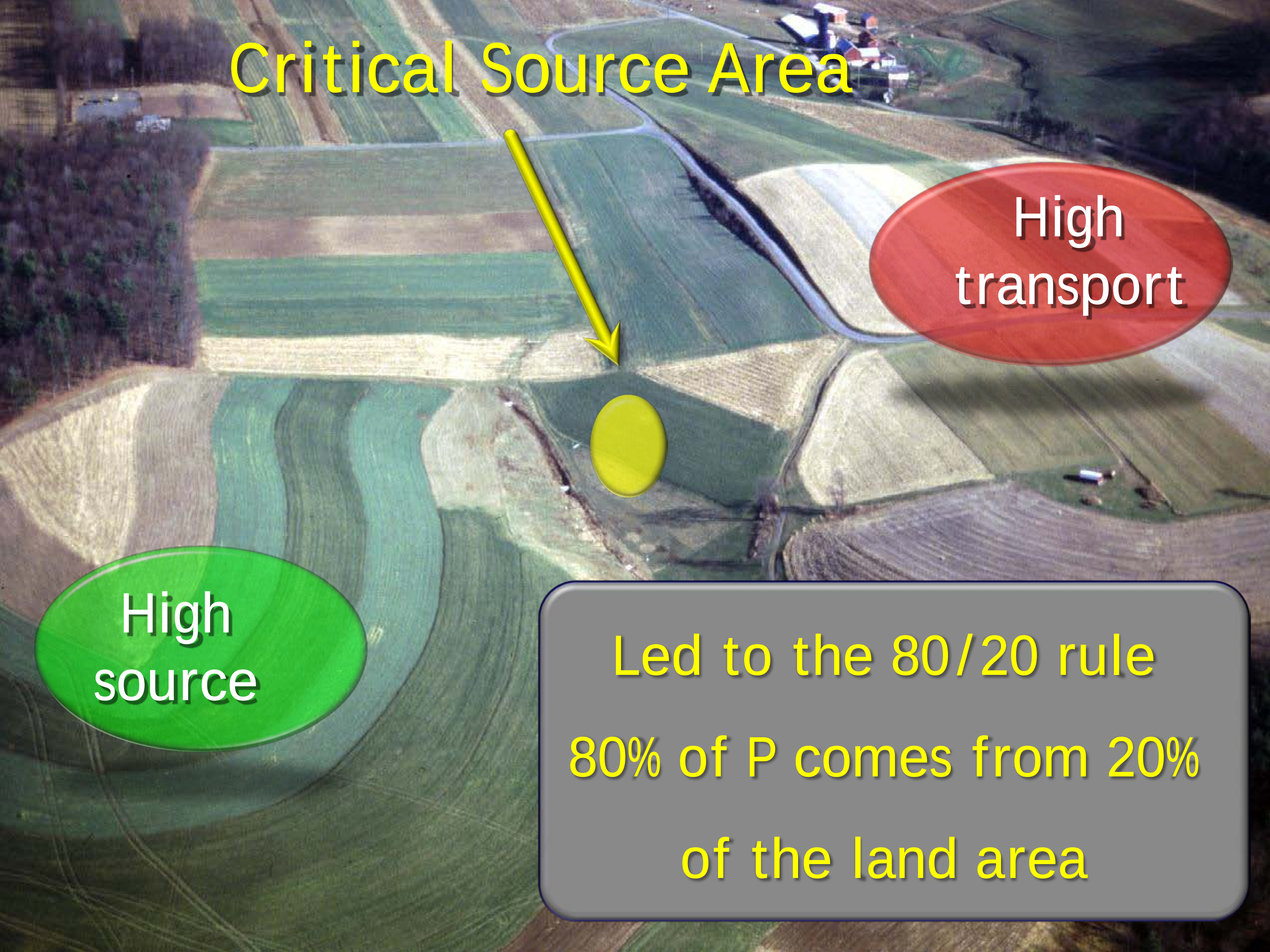
Process of P loss



Science influencing policy

- <u>1997</u> - Maryland implements restrictive soil P thresholds for manure mgt.
- <u>1998</u> - Group of scientists meet with MD Gov. Gilchrest
  - Presented the science behind P-based mgt.
- <u>2000</u> - Risk assessment approach to manure management adopted
  - Now used by 47 of 50 states


P loss affected by many factors
78
0
4620
8
144
177
97
55
92
44
1
<1
Soil P – ppm
P added – kg P/ha/yr
Runoff – liters
P loss – kg P/ha/yr
Tony Buda, ARS, PA


Critical Source Area
High transport
High source
Led to the 80/20 rule
80% of P comes from 20%
of the land area

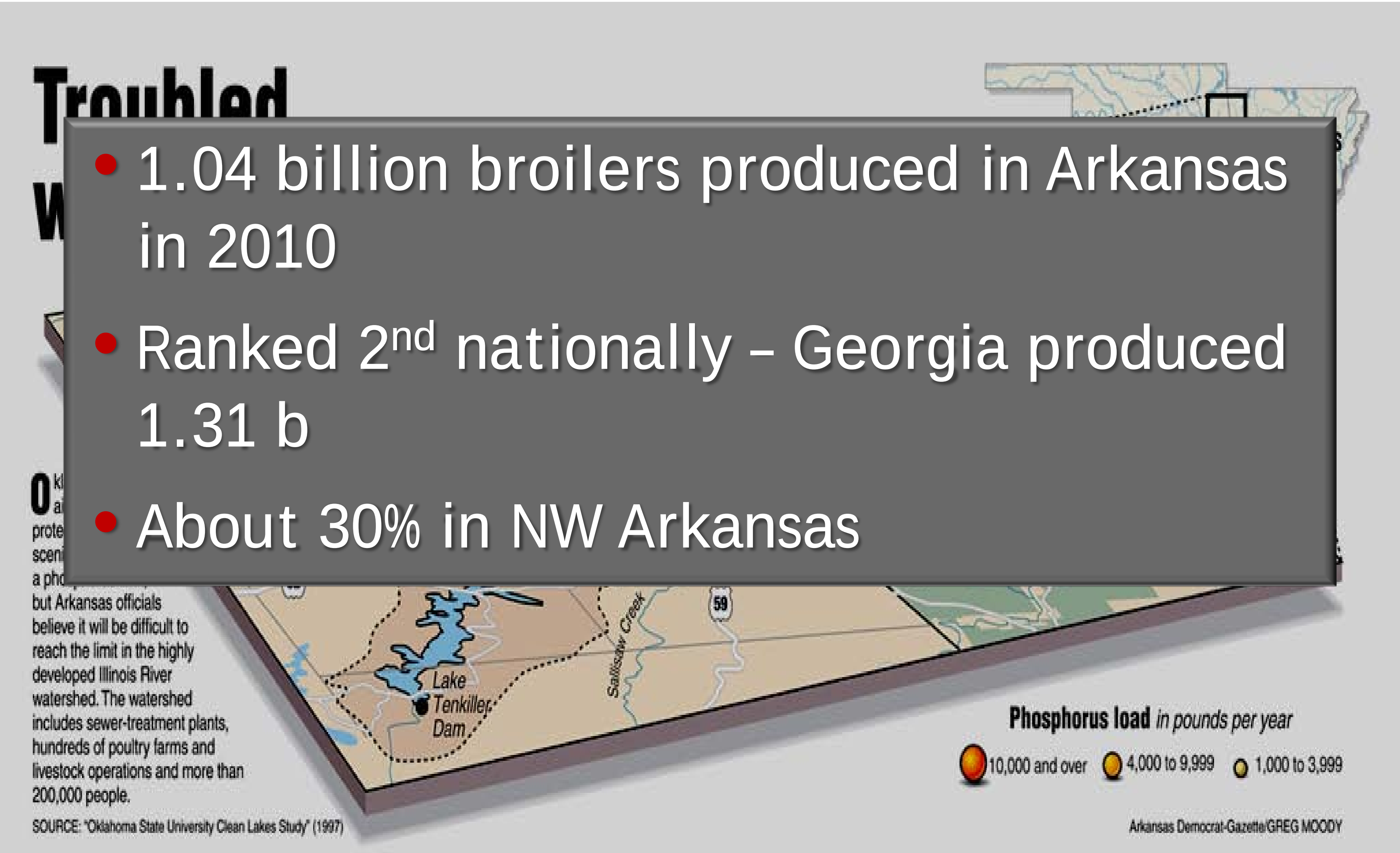
The breakdown ....

- In many states, land applied manure rates decreased
- But, disparity among states
  - Recommendations vary with State's policy
  - Often not leading to better water quality
- But ....

<u>THESE TOOLS NEVER MEANT TO BE THE SOLUTION</u>

Litigated nutrient management

- 1.04 billion broilers produced in Arkansas in 2010
- Ranked 2nd nationally – Georgia produced 1.31 b
- About 30% in NW Arkansas



The lawsuit

- Mandated
  - Soil test P threshold / limit
  - Less poultry litter applied to pastures
  - Export 33% of litter out of watershed
- Required scientists to work with lawyers
  - Develop science-based tracking tools and management solutions

The breakdown ….

- Many examples of how science has helped define local and national environmental policy
- However, policy can often define how the science is presented

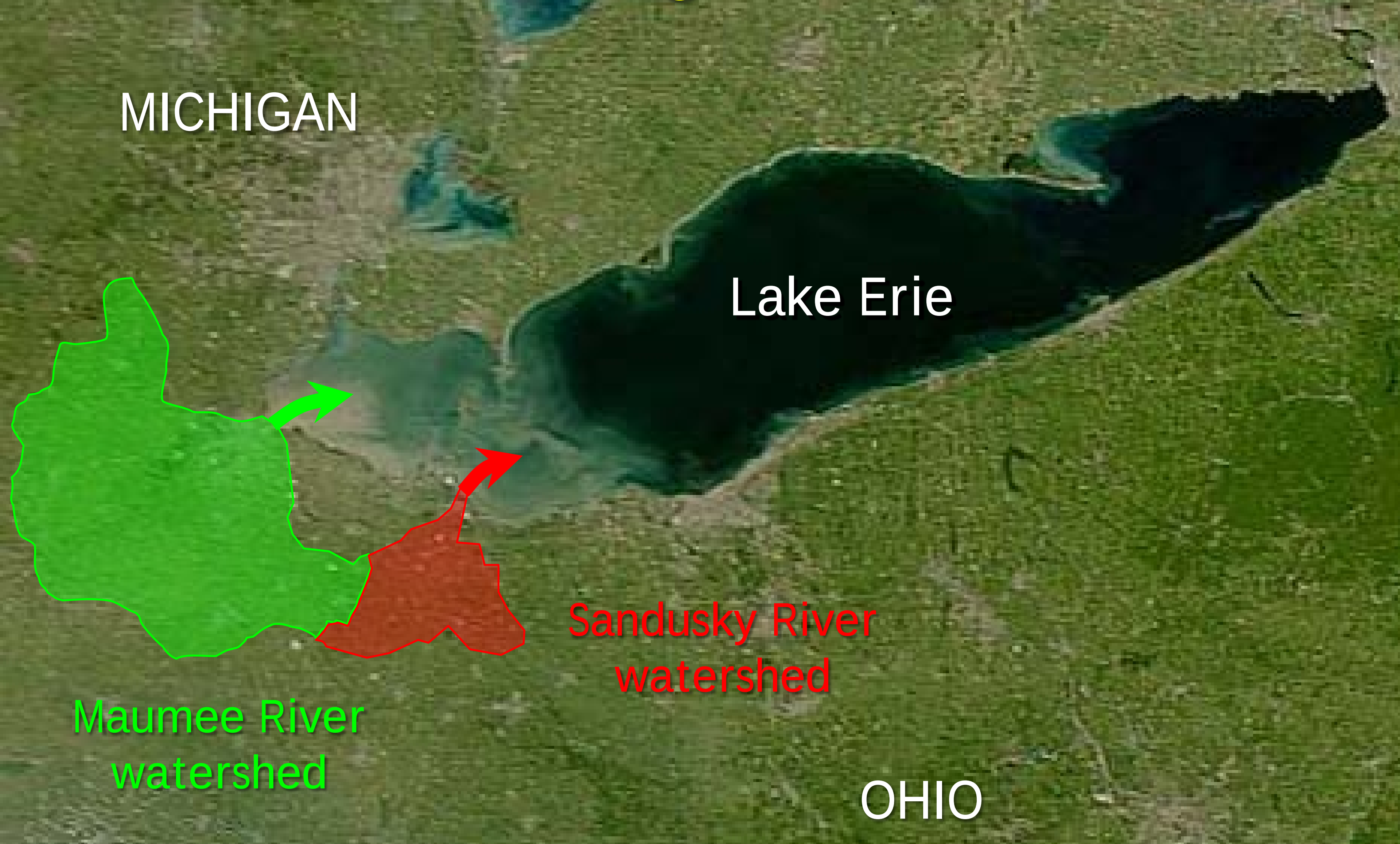
Lessons learnt

- ~ 75% litter exported from watershed
  - 65,000 tons / year
  - 1.7 million lbs P / year
- Economic impact on beef grazers
  - Loss of nutrients and forage production
  - ~$40 K / year loss
- Potential water quality impact
  - Increased erosion due to poorer ground cover

The Illinois River Watershed Partnership

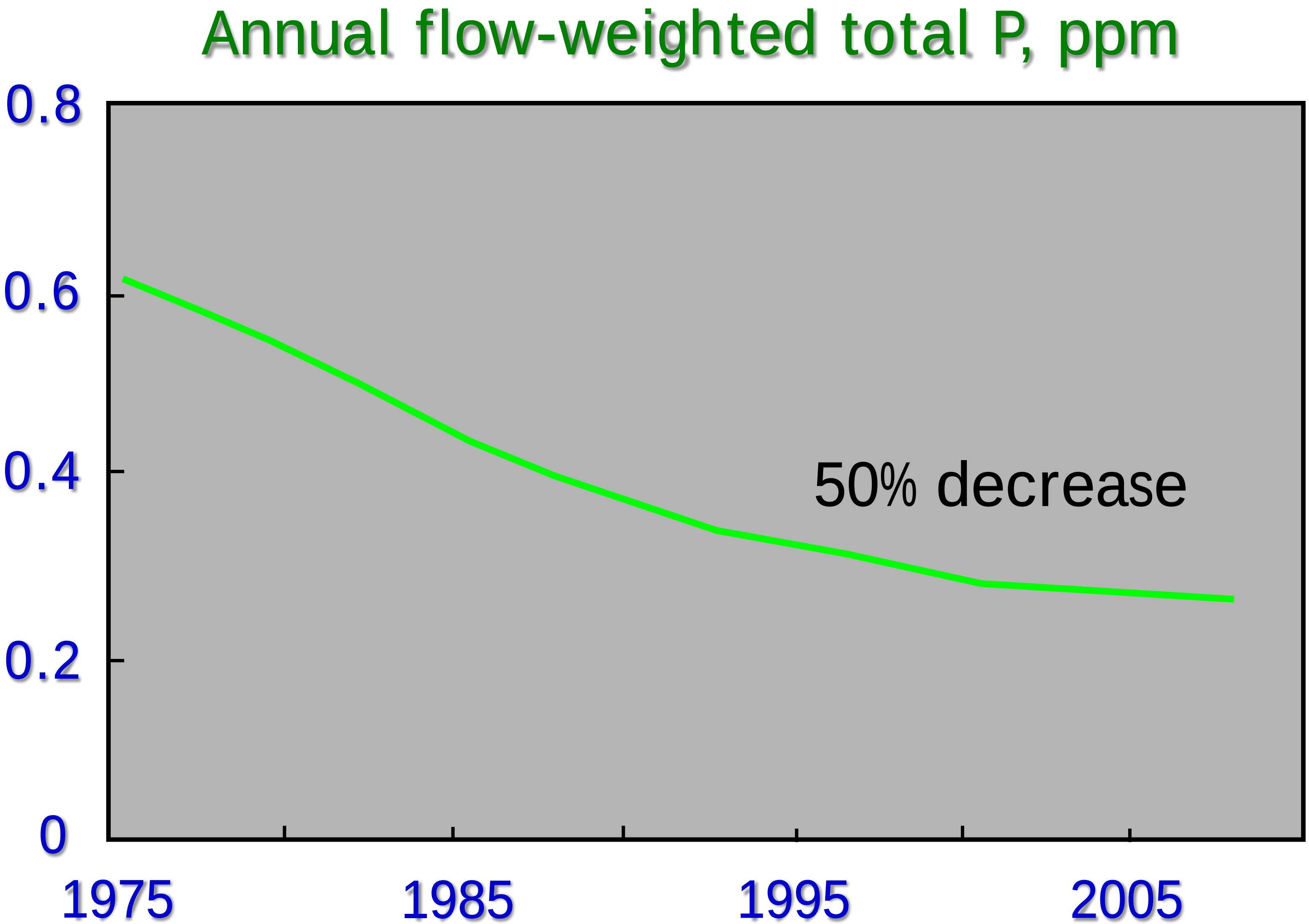
- Stakeholders from Arkansas and Oklahoma
  - Educational programs
  - Riparian buffer establishment
  - Volunteer stream water quality monitoring
- Some fracturing between point and nonpoint entities

Unintended consequences of conservation management



Pete Richards & David Baker, OH

Trends in P - Maumee River



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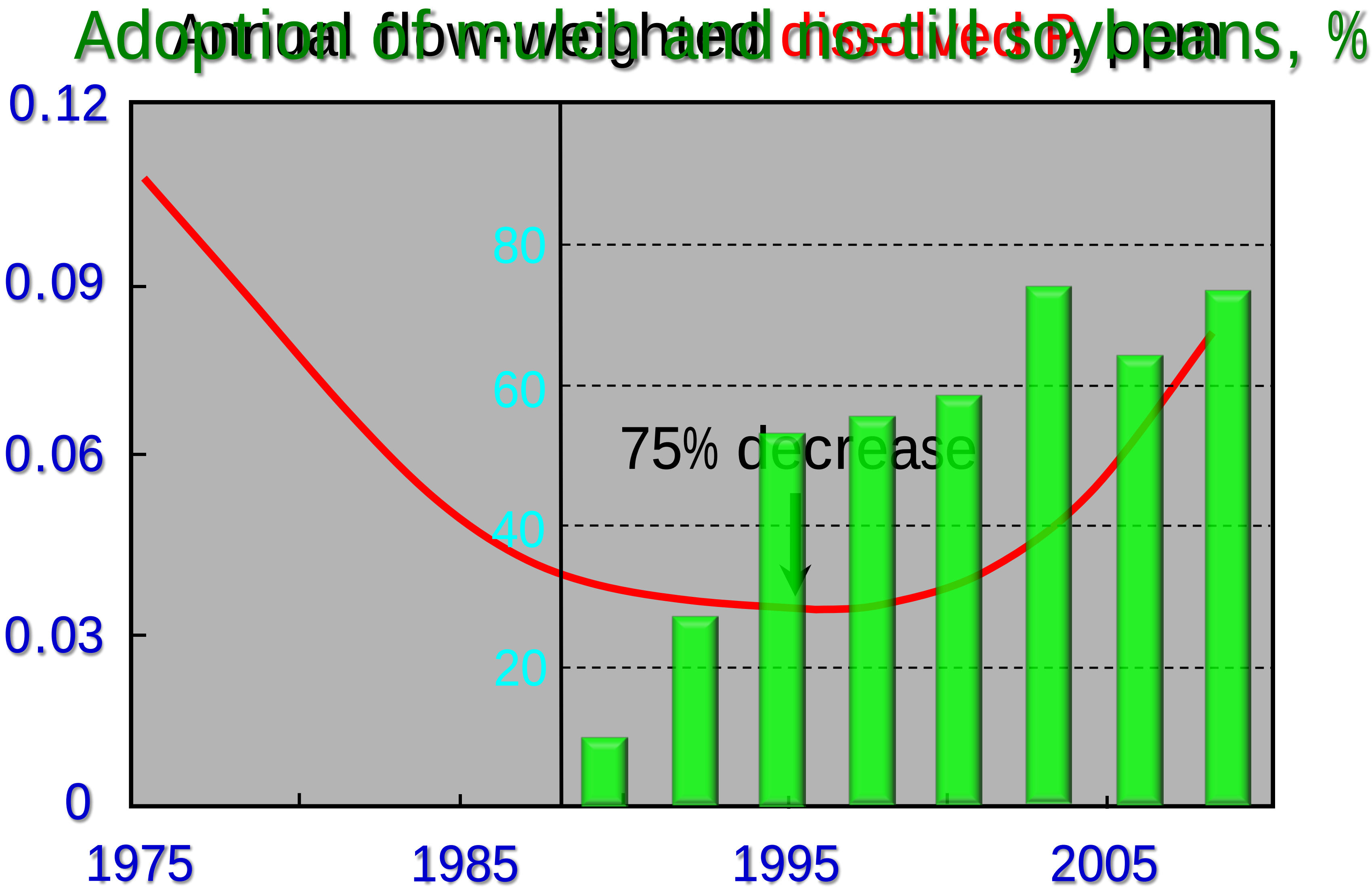
Trends in P - Maumee River



Dave Baker & Peter Richards, OH

Lessons learnt

- Weather exacerbated trends
- Response to mgt. change takes time
- Adaptive management may have reduced nutrient loss
  - Incorporation of fertilizer and manure
  - Winter cover crops
  - Spring fertilization

But the reality is …….

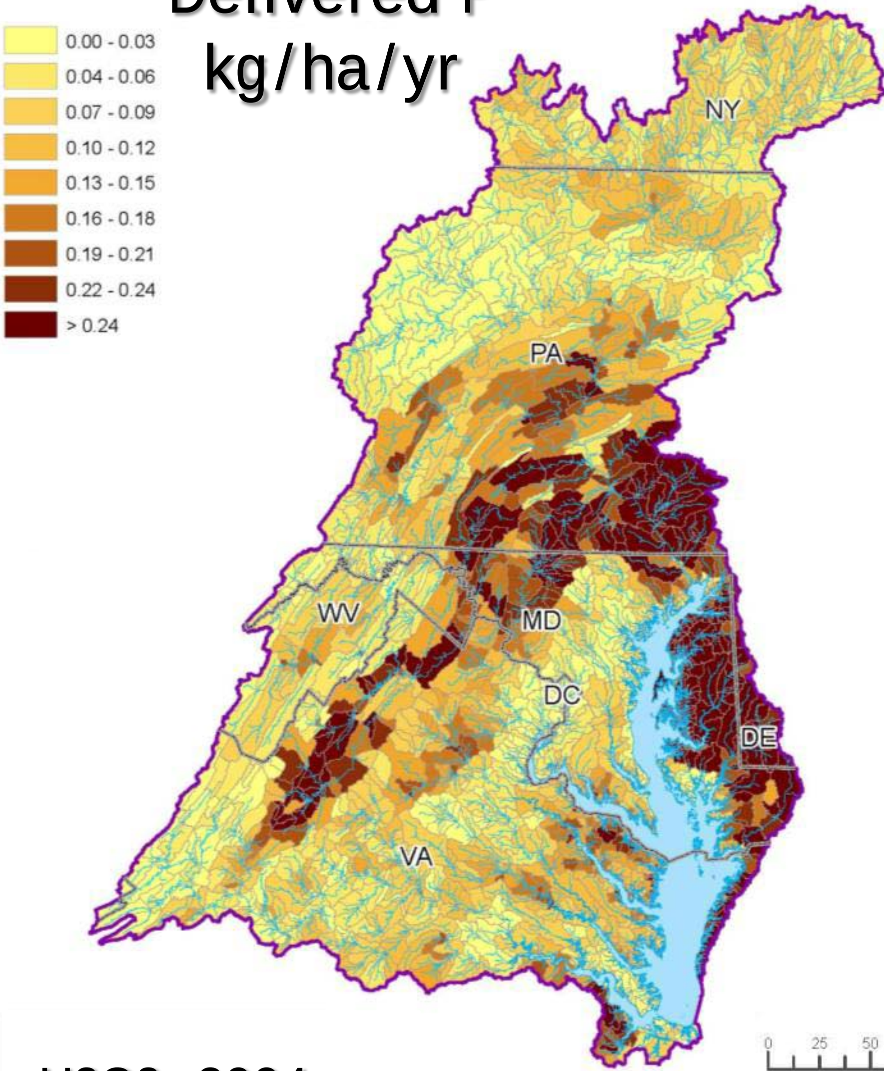
- Fertilizer dealer perspective
  - Large spring workload
  - Usually, spring fertilizer costs more
  - Labor and equipment abundant in winter
- Farmer perspective
  - Spring workload is huge
  - Lower price
  - Less soil compaction on frozen ground
  - More time-sensitive tasks in spring

Legacy effects and response to watershed management change

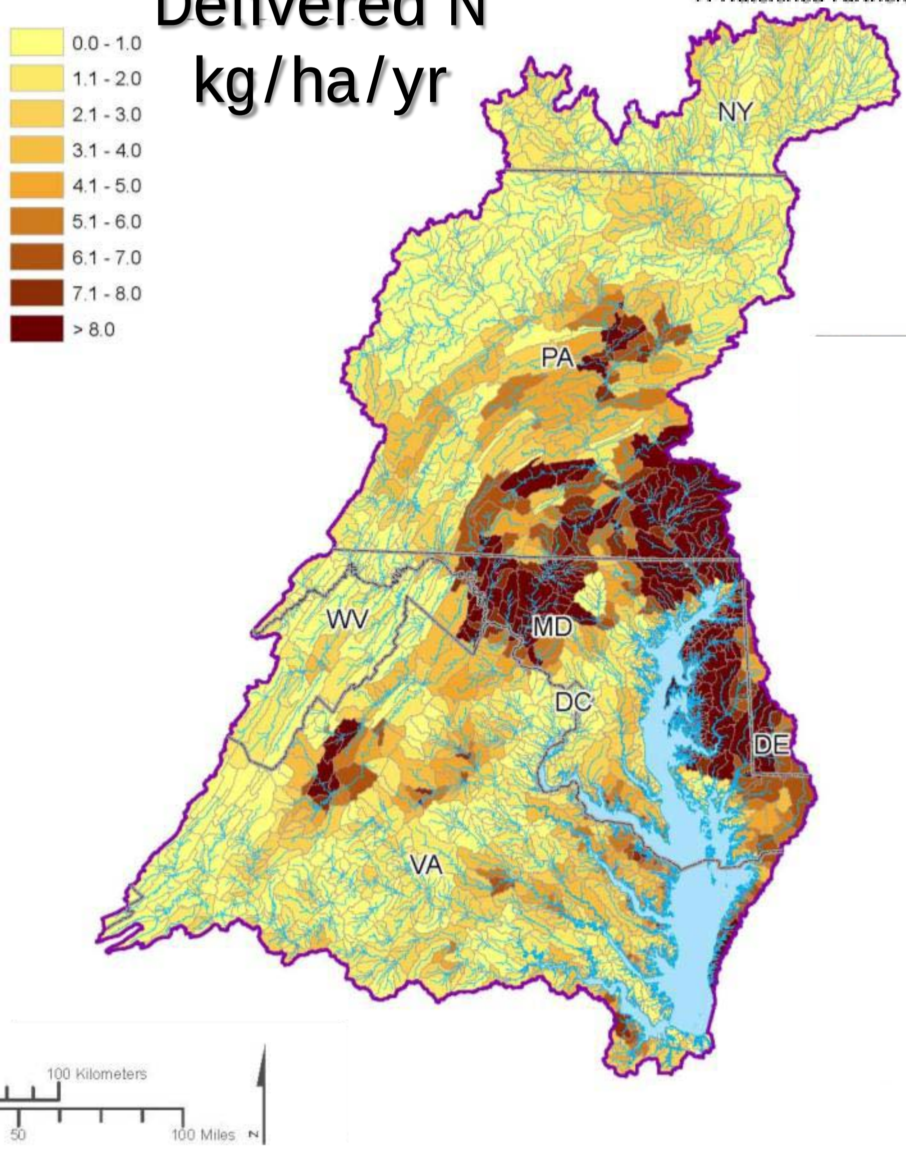
Agricultural sources

Chesapeake Bay Program
A Watershed Partnership

Delivered P
kg/ha/yr

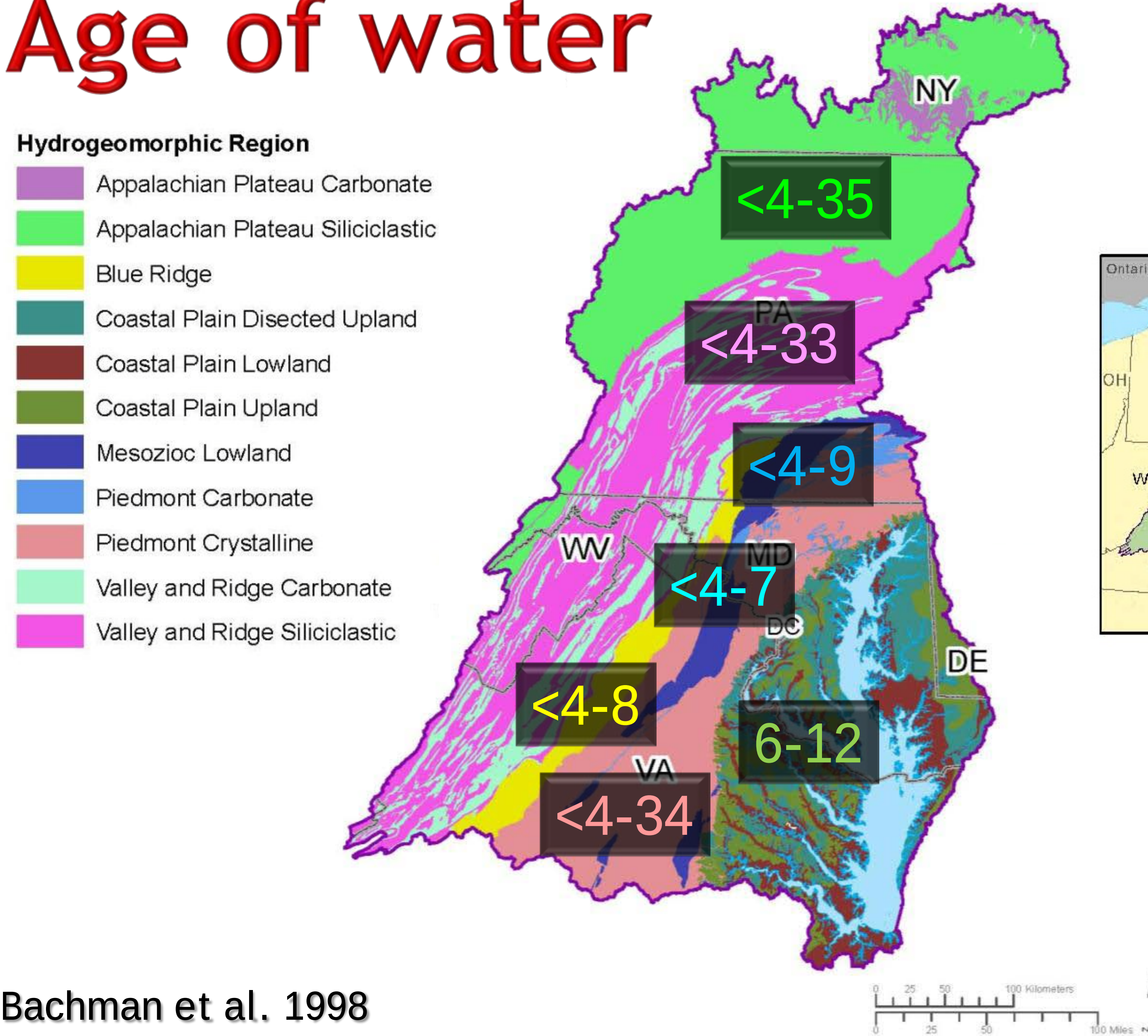


Delivered N
kg/ha/yr



USGS, 2004

Age of water



Bachman et al. 1998

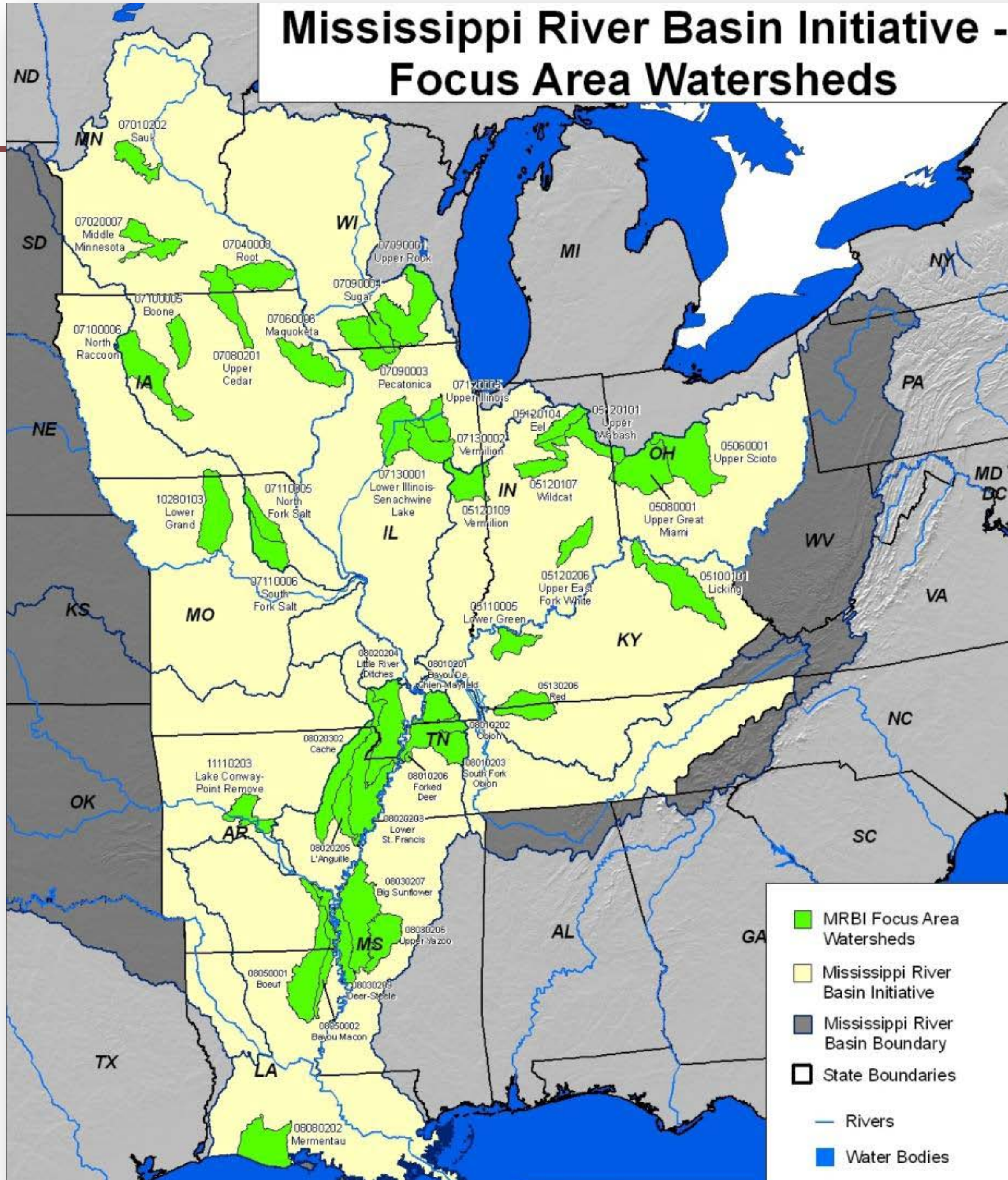
Legacy effect on system response

- Nutrients
  - N - groundwater flow pathways 1 to >30 yr
  - P - release from high P soils & sediments
- Sediment
  - Response more immediate – effect on light penetration
- Lag times increase with scale
  - Demonstrate success at subwatershed level

Use of models

- Models are a representation of reality
- Use in numeric nutrient criteria & TMDL development
  - Chesapeake Bay Model, Florida waters
- Models inform decisions
  - Best way to prioritize finite resource allocation; e.g., NRCS Mississippi River Basin Initiative

Mississippi River Basin Initiative - Focus Area Watersheds



Input discrepancies

	EPA	USDA	Diff.
	million acres		%
Land area	41.1	42.5	3
Agricultural land	9.0	12.1	35
Cropped	3.3	4.4	33
Conventional till	1.7	0.4	-74
Conservation till	1.7	3.9	133

LimnoTech 2011

Lessons learnt

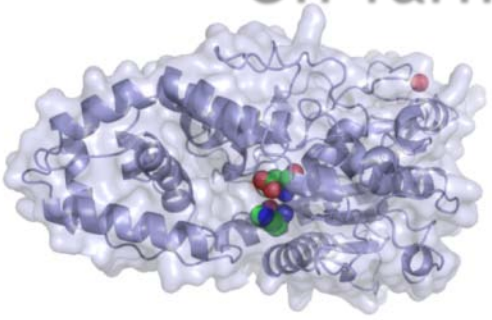
- Use right model to meet defined goals
- Models have uncertainty, due to
  - Model limitations
  - Input data availability
  - BMP N & P reduction efficiencies
  - Legacy effects
- Models must be used at same scale and boundaries at which calibrated

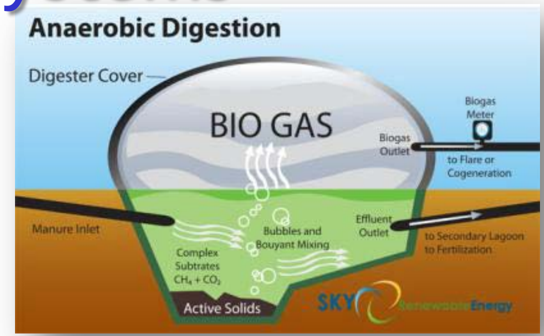
The breakdown ….

- Policy requires black & white guidelines
- Science tries to account for all variables and situations
- Keep it simple!

Thoughts on the future

- Nutrient management planning
  - National guidelines for manure mgt. – 4 R's
  - Livestock diets & use of enzymes
  - Manure treatment & transport
  - Alternative uses
    - Burning – electricity generation – use of char
    - Digestion – methane production – use of sludge
    - On-farm & cooperative-based systems





Thoughts on the future

- Managing public expectations
  - Realistic goal setting
  - Targeted remedial management
    - Tracking, accounting & inspection of cost-shared and voluntary BMPs
  - Robust monitoring to document change
    - Focus at field and sub-watershed level
  - Explaining legacy effects
    - Reduce public disillusionment and impatience

Thoughts on the future

- NRCS will struggle to enforce environmental stewardship measures
- Combination of required environmental standards and voluntary programs
- Watershed partnerships and coalitions have role to play

The Discovery Farms Program

Wisconsin - 2001: Dennis Frame

drframe@wisc.edu

North Dakota – 2007 – Ron Wiederholt

ron.Wiederholt@ndsu.edu

Arkansas – 2008 – Andrew Sharpley

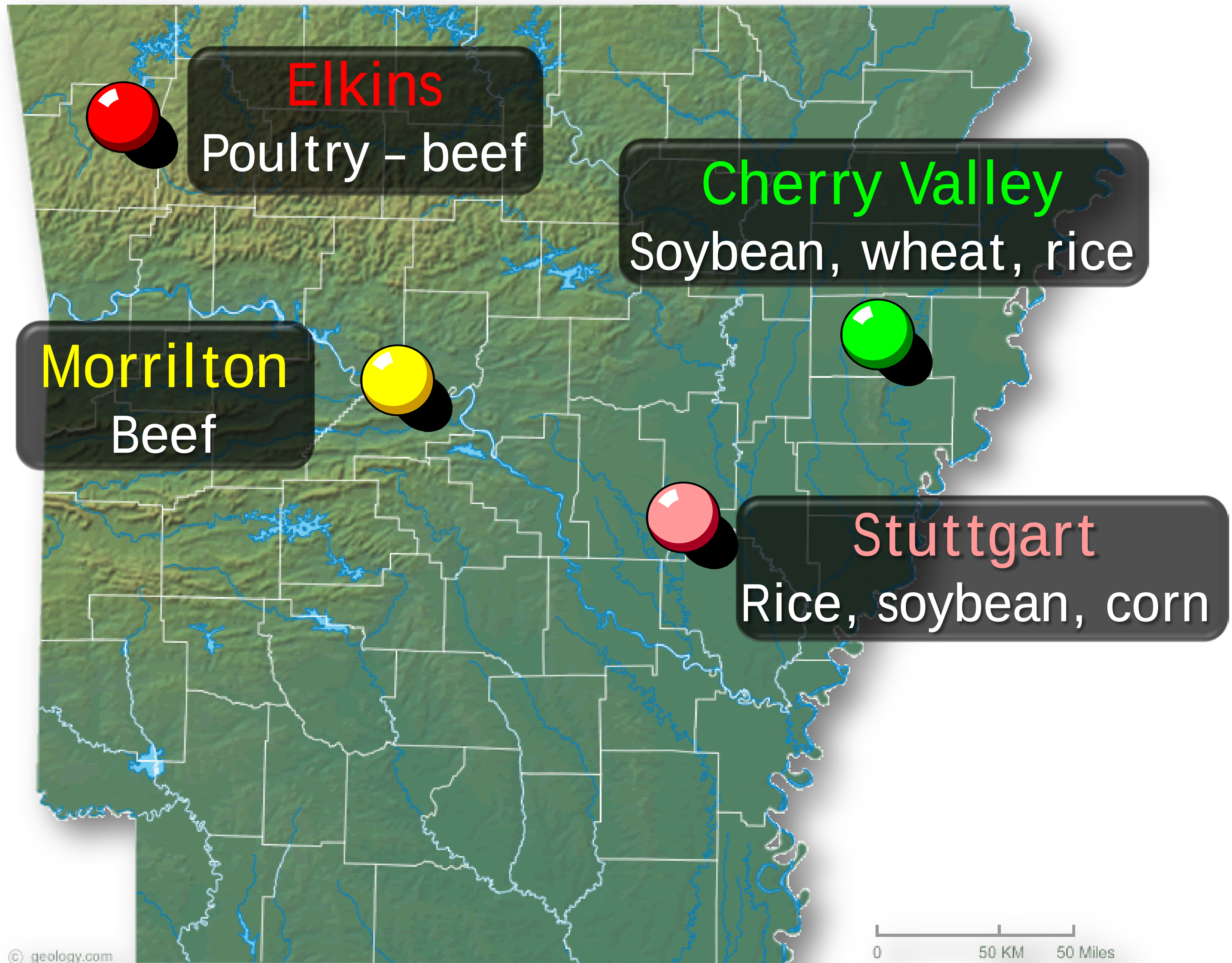
sharpley@uark.edu

Minnesota - 2009 – George Rehm

rehmx001@umn.edu

Why we need it ….

- Several core farms across region
  - Reflect dominant farm systems
- On-farm research and demonstration
- Address local and regional water issues
  - Northwest Arkansas
  - Gulf of Mexico hypoxia
  - Water quantity and use issues
- Demonstrate success stories


Elkins
Poultry – beef
Cherry Valley
Soybean, wheat, rice
Morrilton
Beef
Stuttgart
Rice, soybean, corn
© geology.com
0
50 KM
50 Miles


One of the most important aspects is farmer interaction

Questions ????