Targeting Best Management in Contrasting Watersheds

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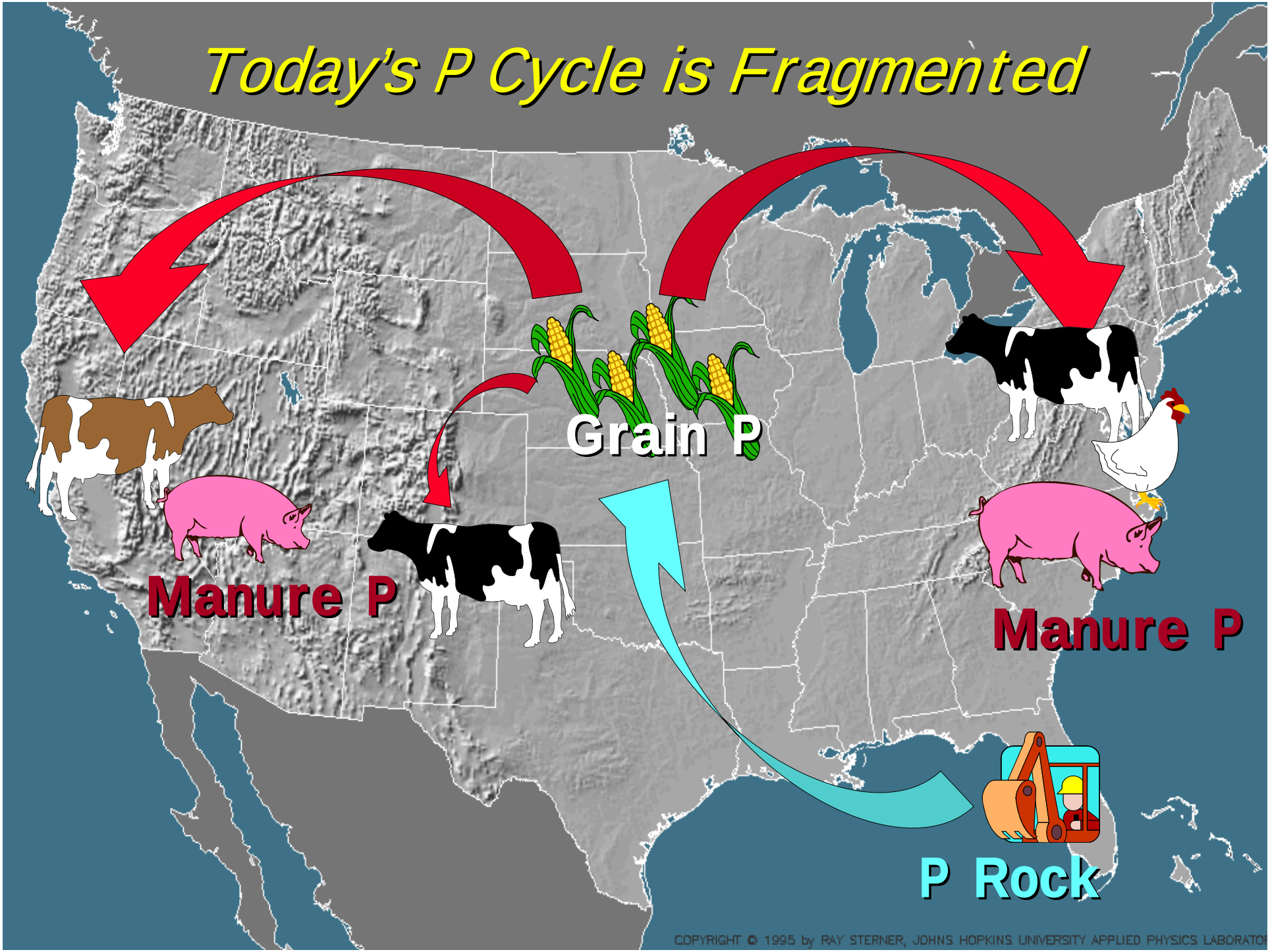
Today's P Cycle is Fragmented
Grain P
Manure P
Manure P
P Rock
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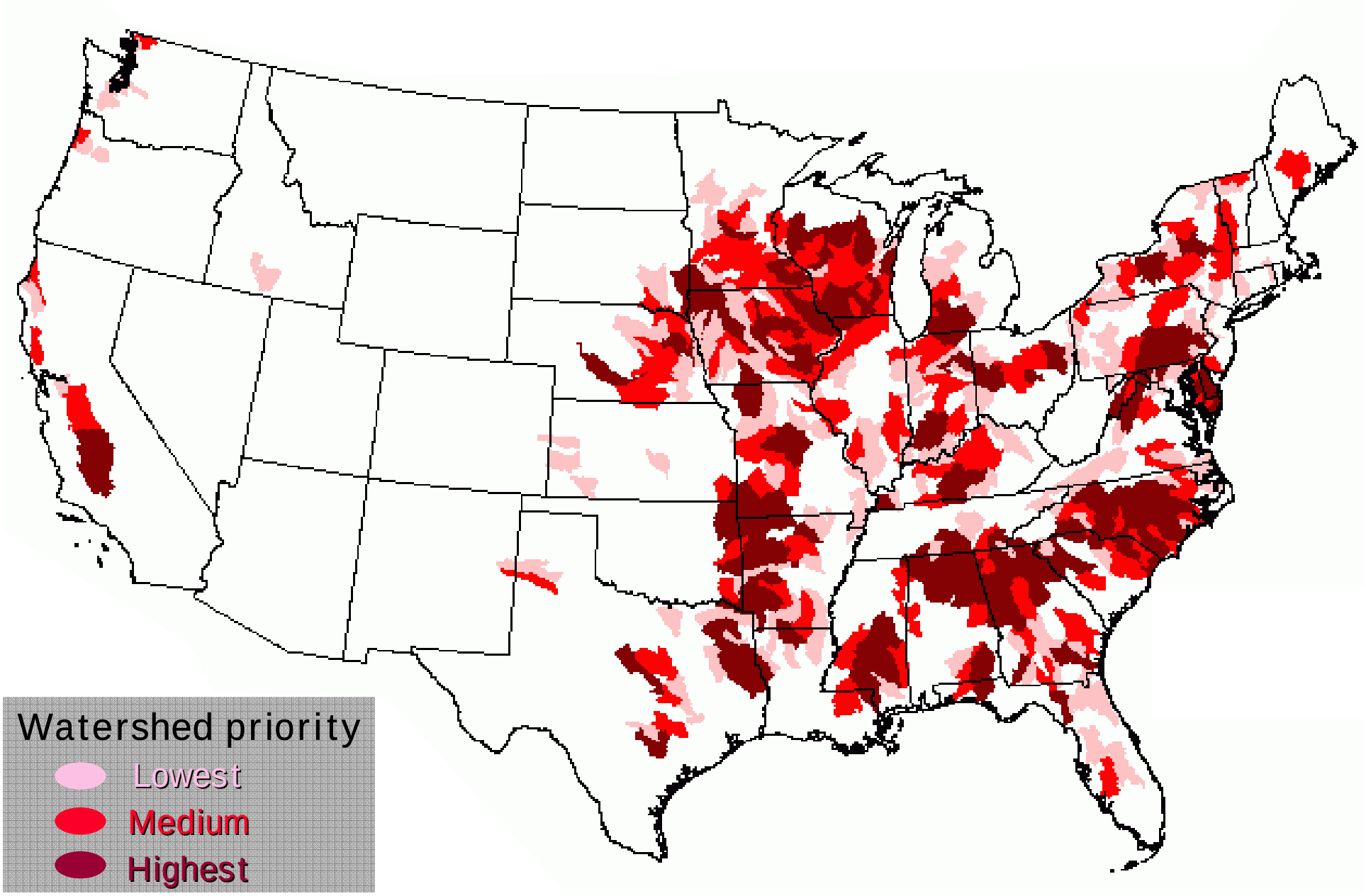
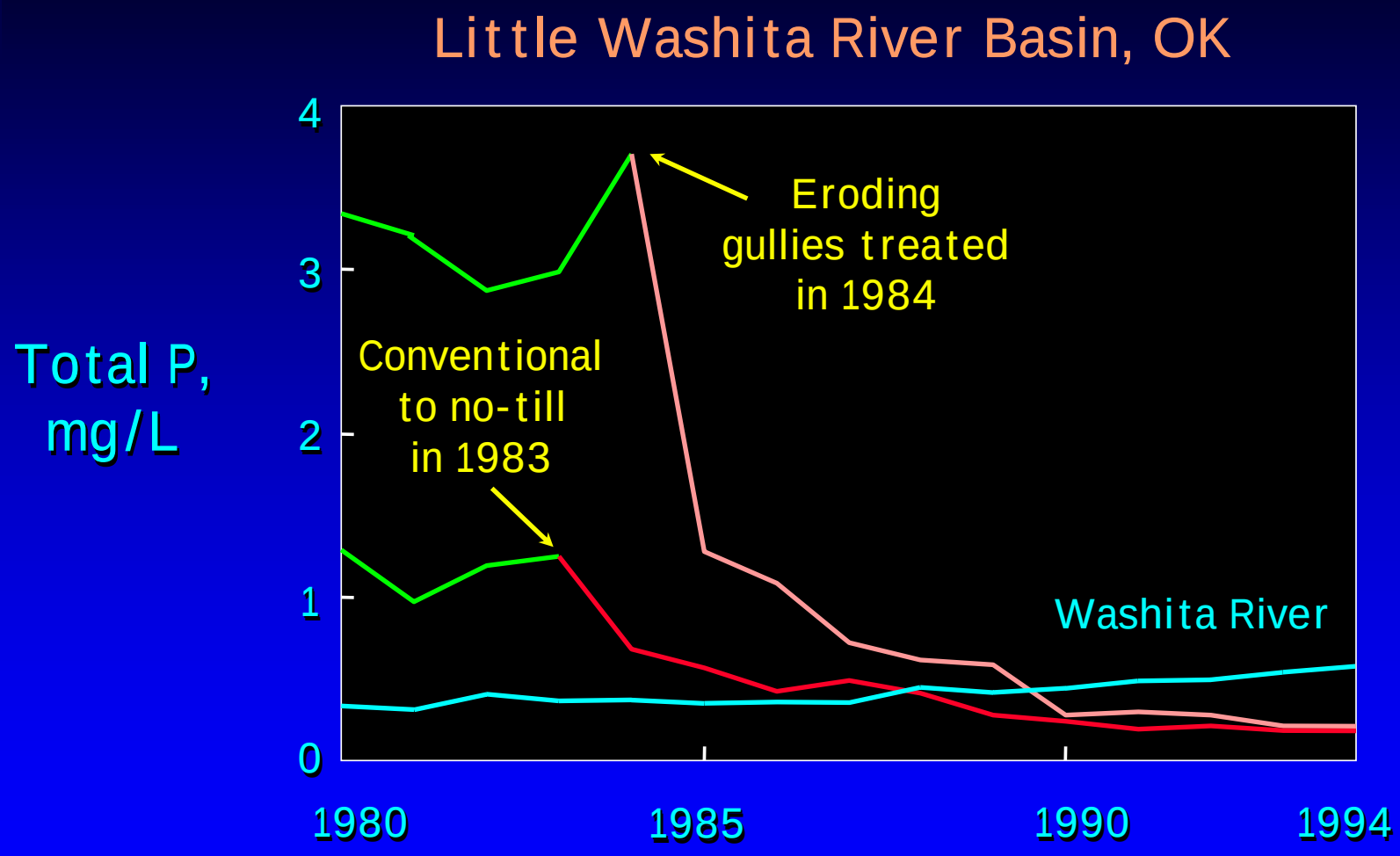
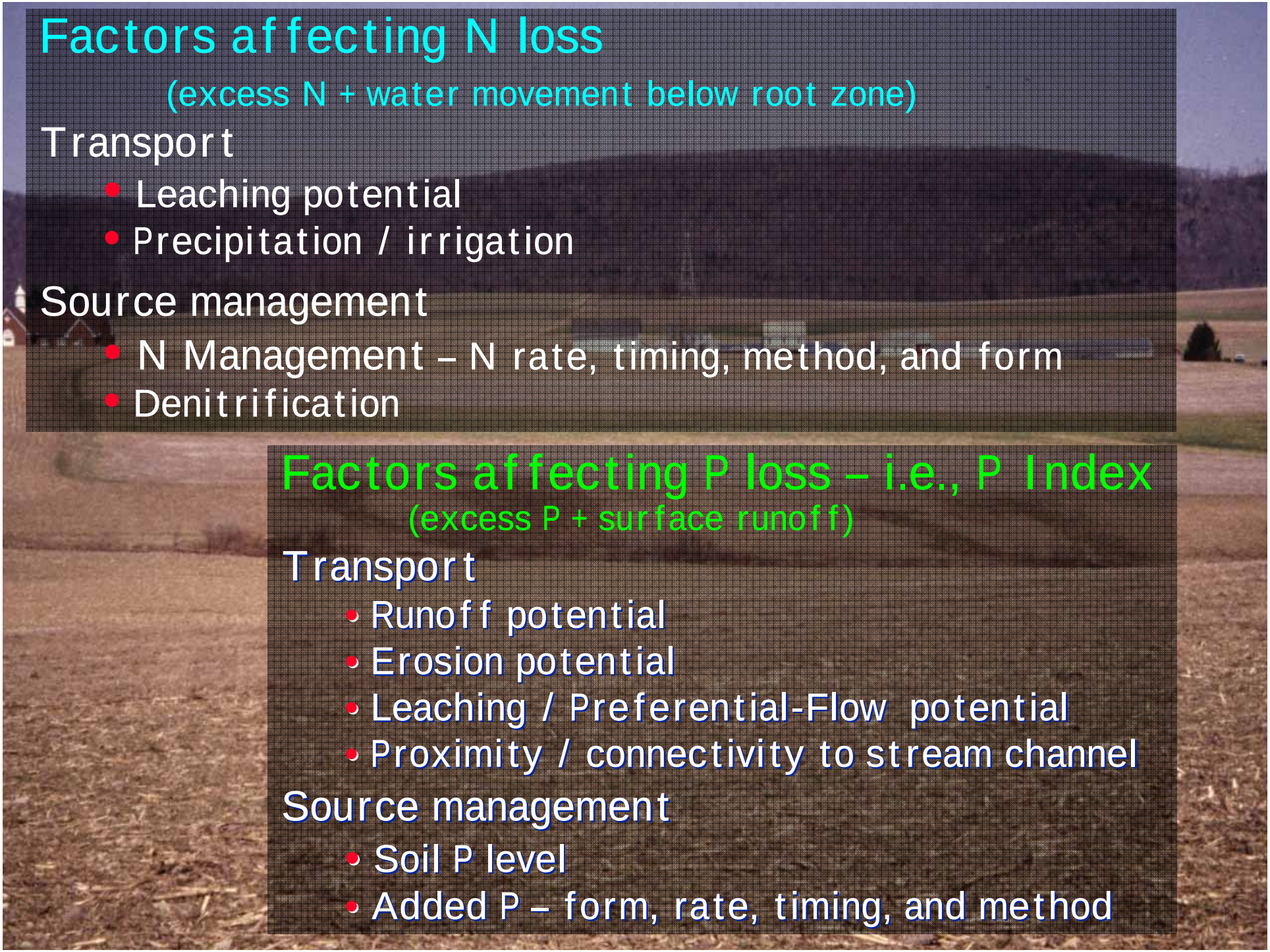
Priority watersheds for water quality protection from contamination by manure nutrients



Poorly targeted BMPs have little impact





Factors affecting N loss

(excess N + water movement below root zone)

Transport

- Leaching potential
- Precipitation / irrigation

Source management

- N Management – N rate, timing, method, and form
- Denitrification

Factors affecting P loss – i.e., P Index

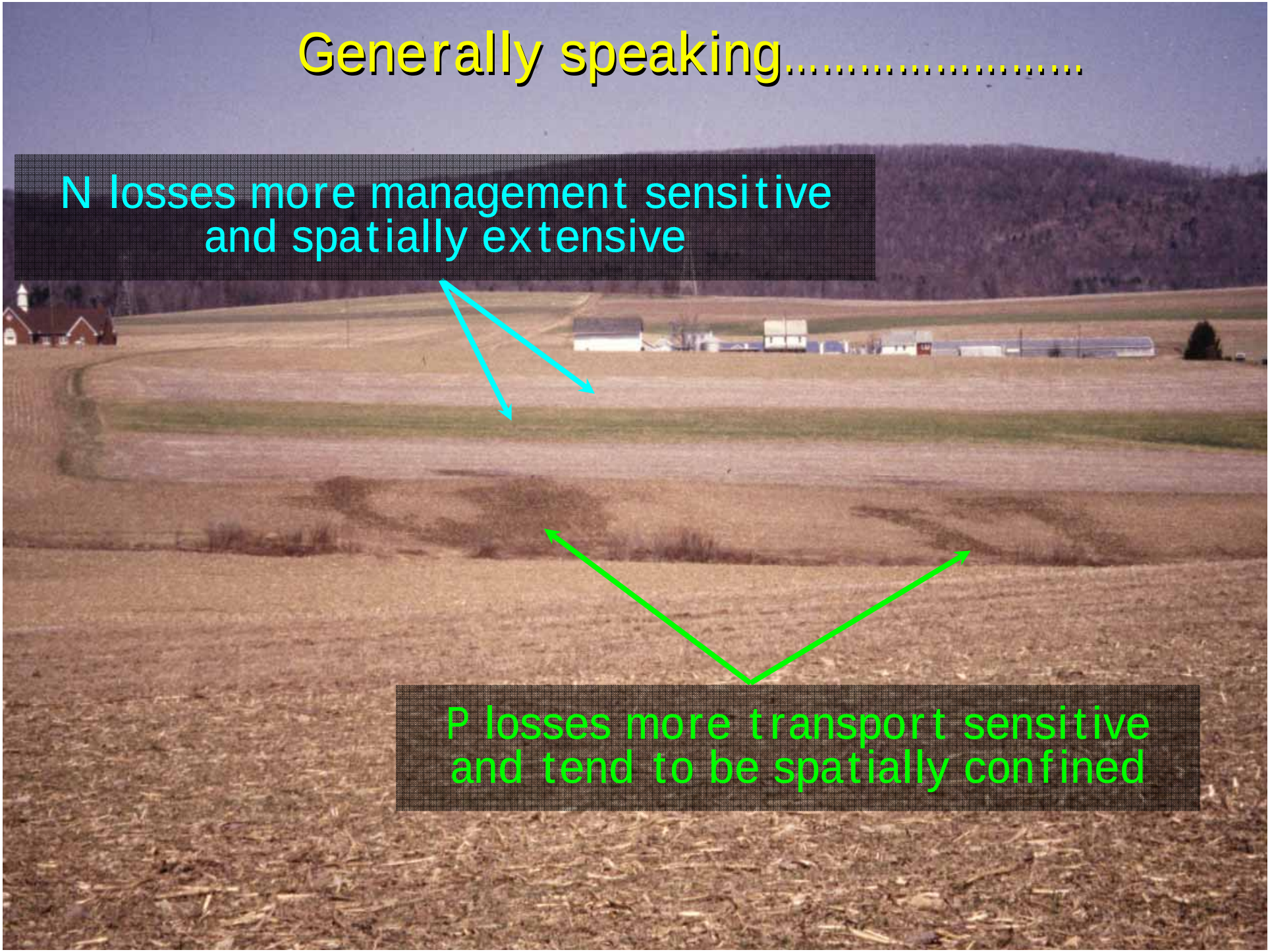
(excess P + surface runoff)

Transport

- Runoff potential
- Erosion potential
- Leaching / Preferential-Flow potential
- Proximity / connectivity to stream channel

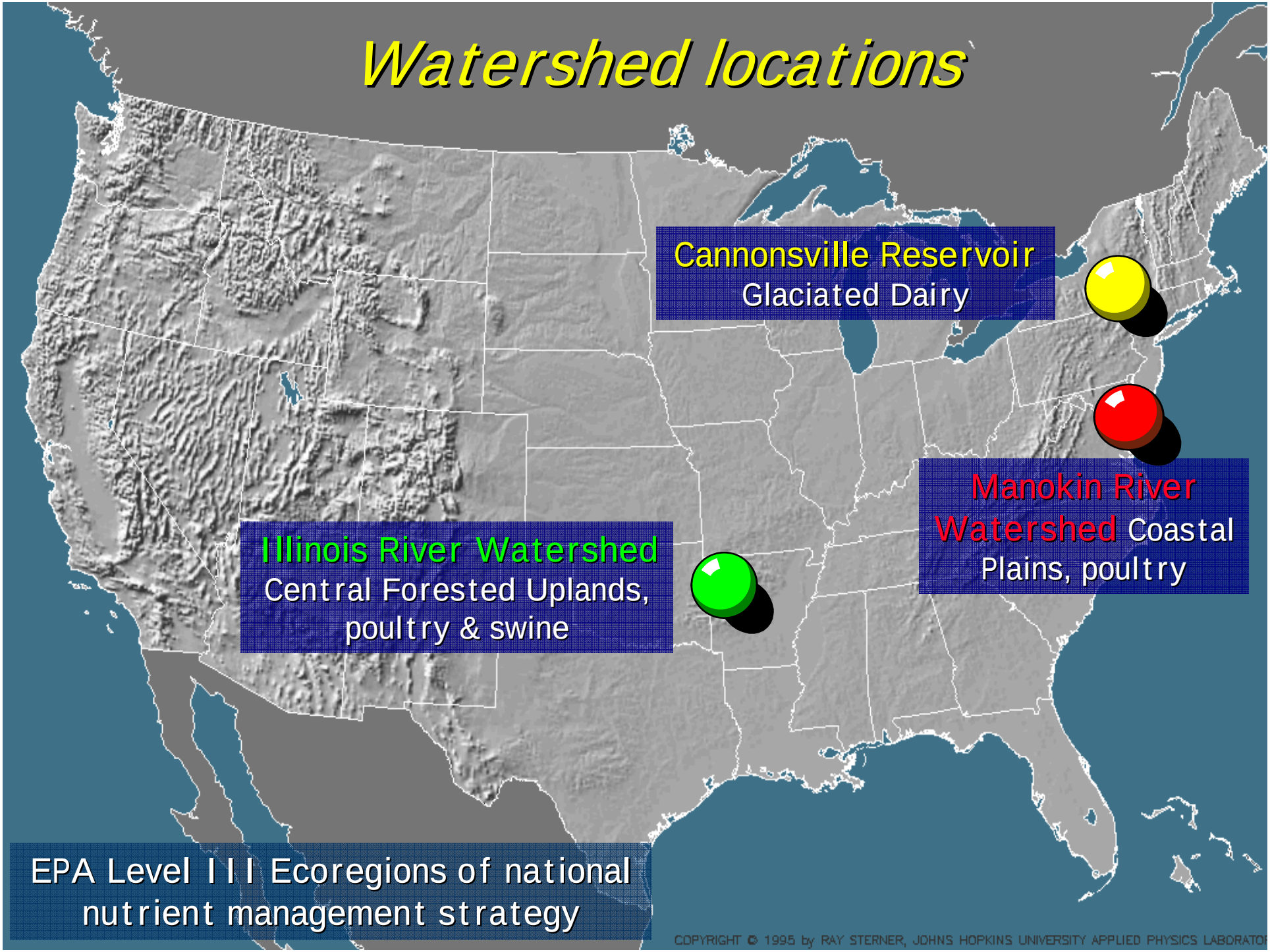
Source management

- Soil P level
- Added P – form, rate, timing, and method


Generally speaking.....
N losses more management sensitive and spatially extensive
P losses more transport sensitive and tend to be spatially confined

Targeted BMPs in contrasting watersheds

- ✓ Several factors affect BMP targeting
  - Physiographic region – topography, geology
  - Land use and management
  - Socio-economic pressures
  - Agri-enterprise infrastucture
- ✓ Thus, remedial strategies will need to consist of
  - Site-specific, flexible options
  - Financial support for implementation and maintenance
    - Cost-share programs
    - Reward-based incentives
  - Trading within and among watersheds


Watershed locations
Cannonsville Reservoir
Glaciated Dairy
Manokin River
Watershed Coastal
Plains, poultry
Illinois River Watershed
Central Forested Uplands,
poultry & swine
EPA Level III Ecoregions of national
nutrient management strategy
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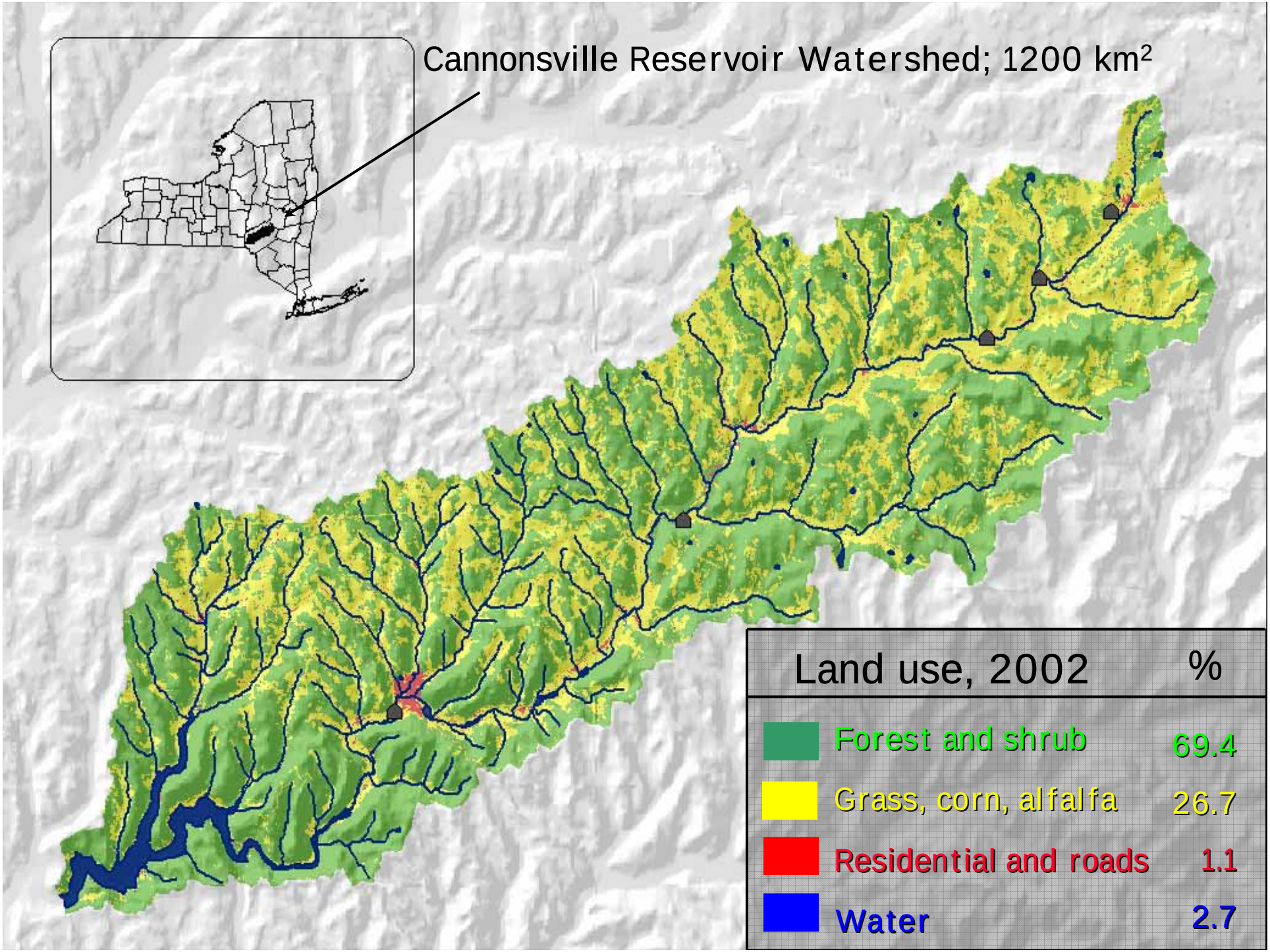
New York City water supply

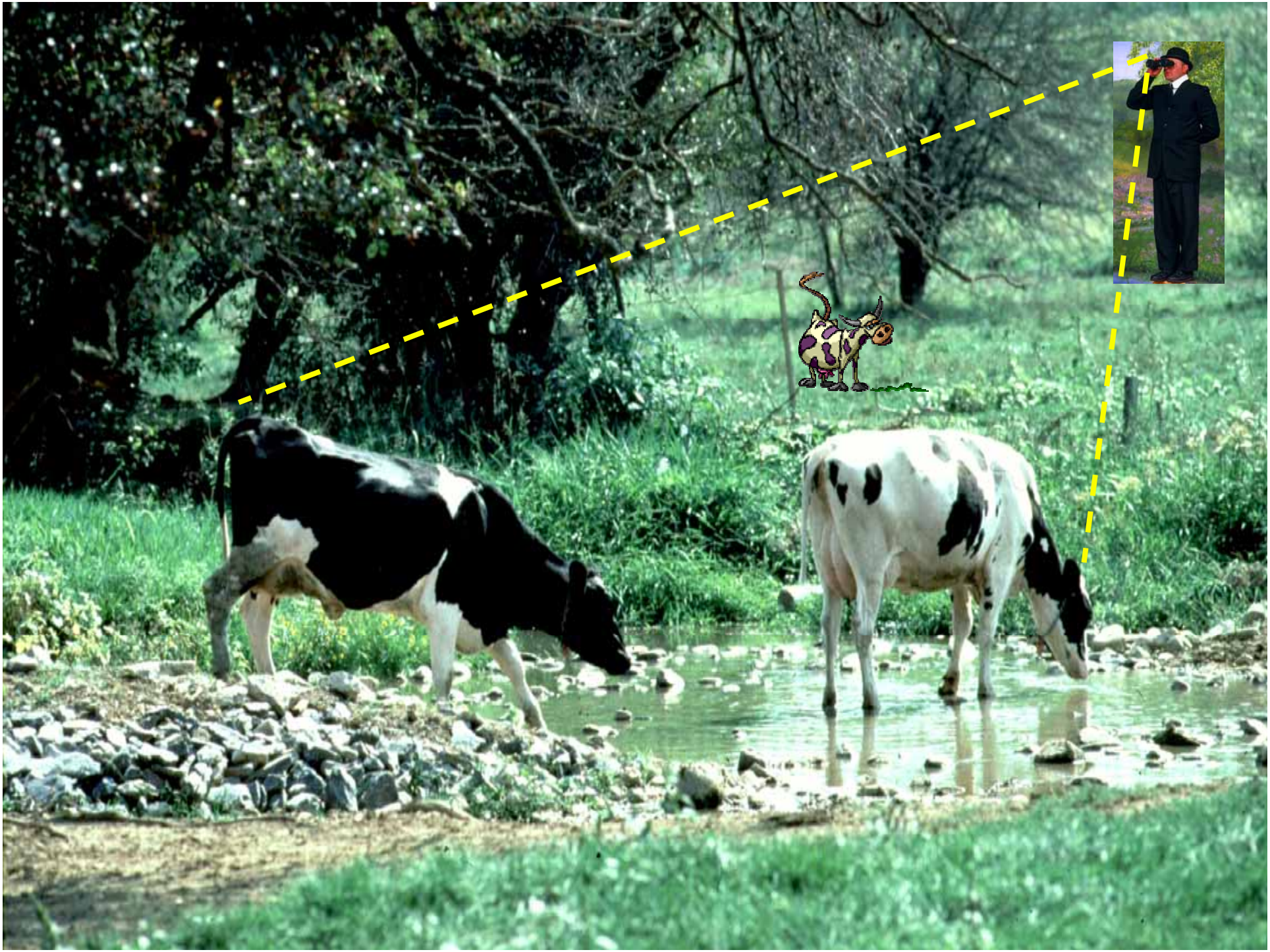
- ✓ 8 million people
- ✓ 1.3 billion gal water daily
- ✓ 2 main reservoir systems
- ✓ Cannonsville Reservoir
  - East of Hudson
    - restricted ag
    - Limits development
  - West of Hudson
    - minimal problems
    - Filtration avoidance ($$)
      - forest and agriculture
      - 100% cost-share for BMPs
      - Targeting in the watershed
      - P-related problems


Cannonsville Reservoir Watershed; 1200 km²
Land use, 2002
%
Forest and shrub
69.4
Grass, corn, alfalfa
26.7
Residential and roads
1.1
Water
2.7

Cannonsville Reservoir Watershed, NY
CEAP

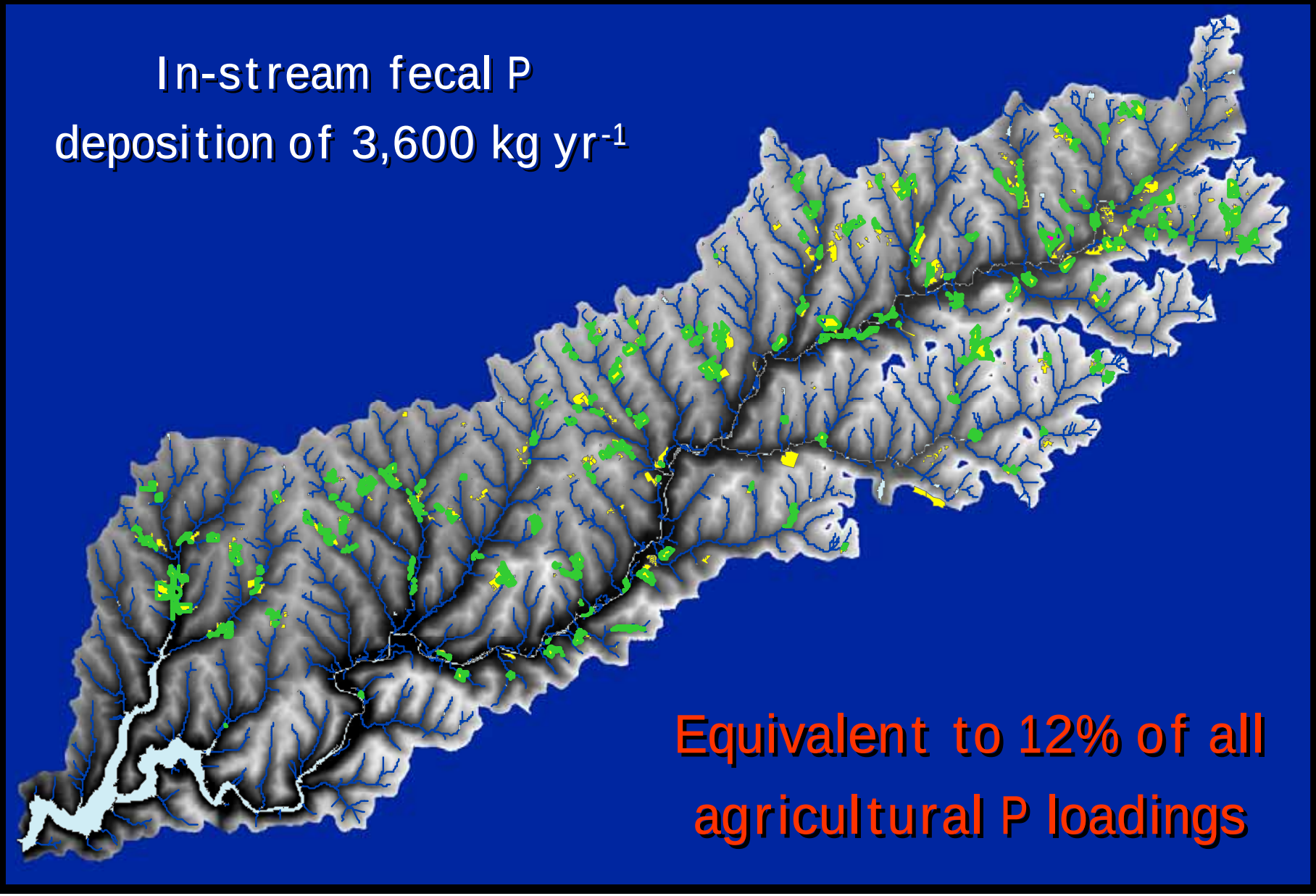
- ✓ 230 dairies – 160 participate in whole-farm planning
  - 60 enrolled in CREP & 40% in EQIP
  - Goal to have 85% participation
- ✓ Main BMPs implemented
  - Decreased dietary feed P
  - Barnyard improvement
  - Milkhouse filters
  - Grazing management
  - Stream exclusion
  - Riparian buffers

Milkhouse waste filter strip



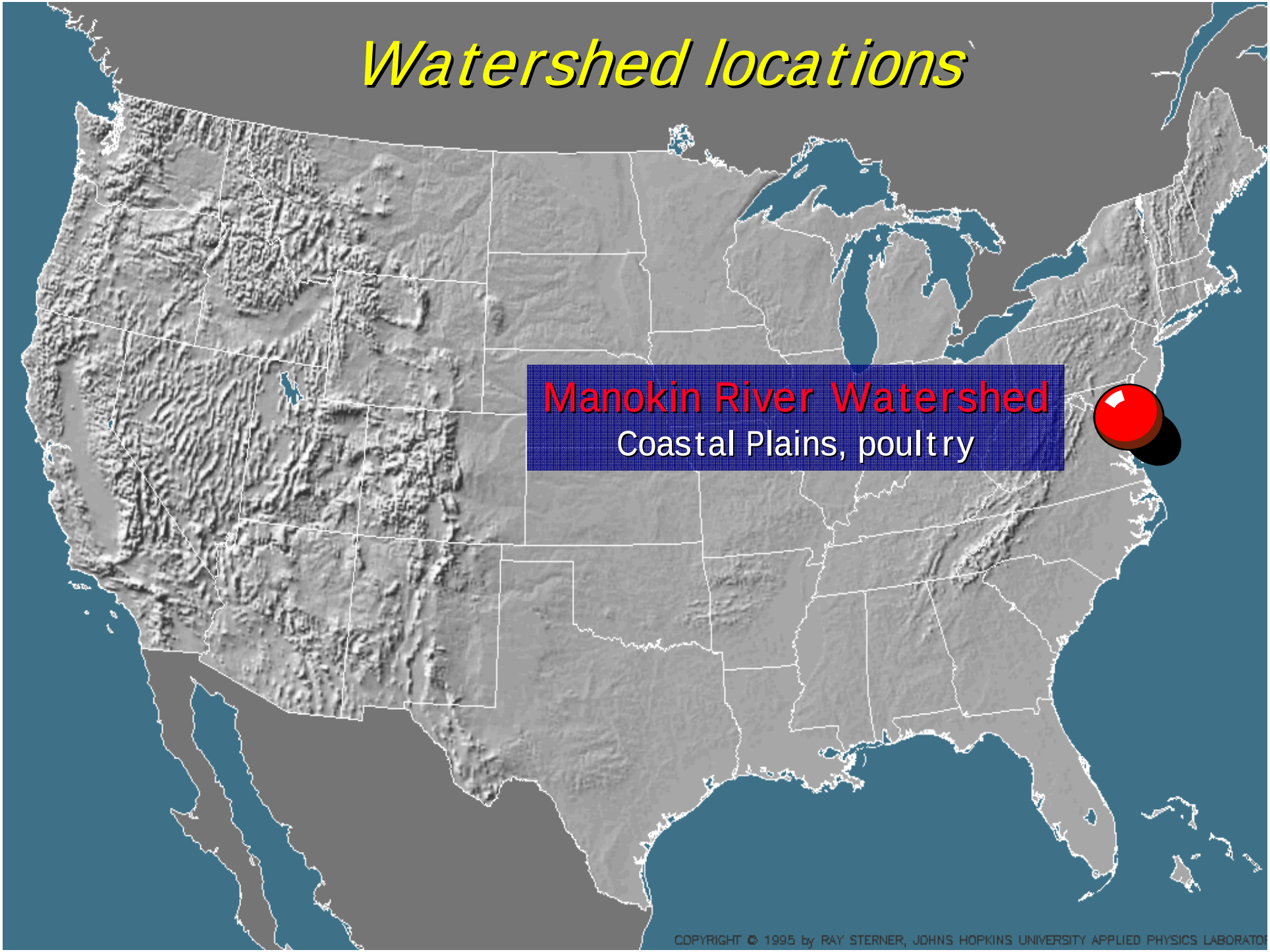

Average “deposit” contains
2 g total P

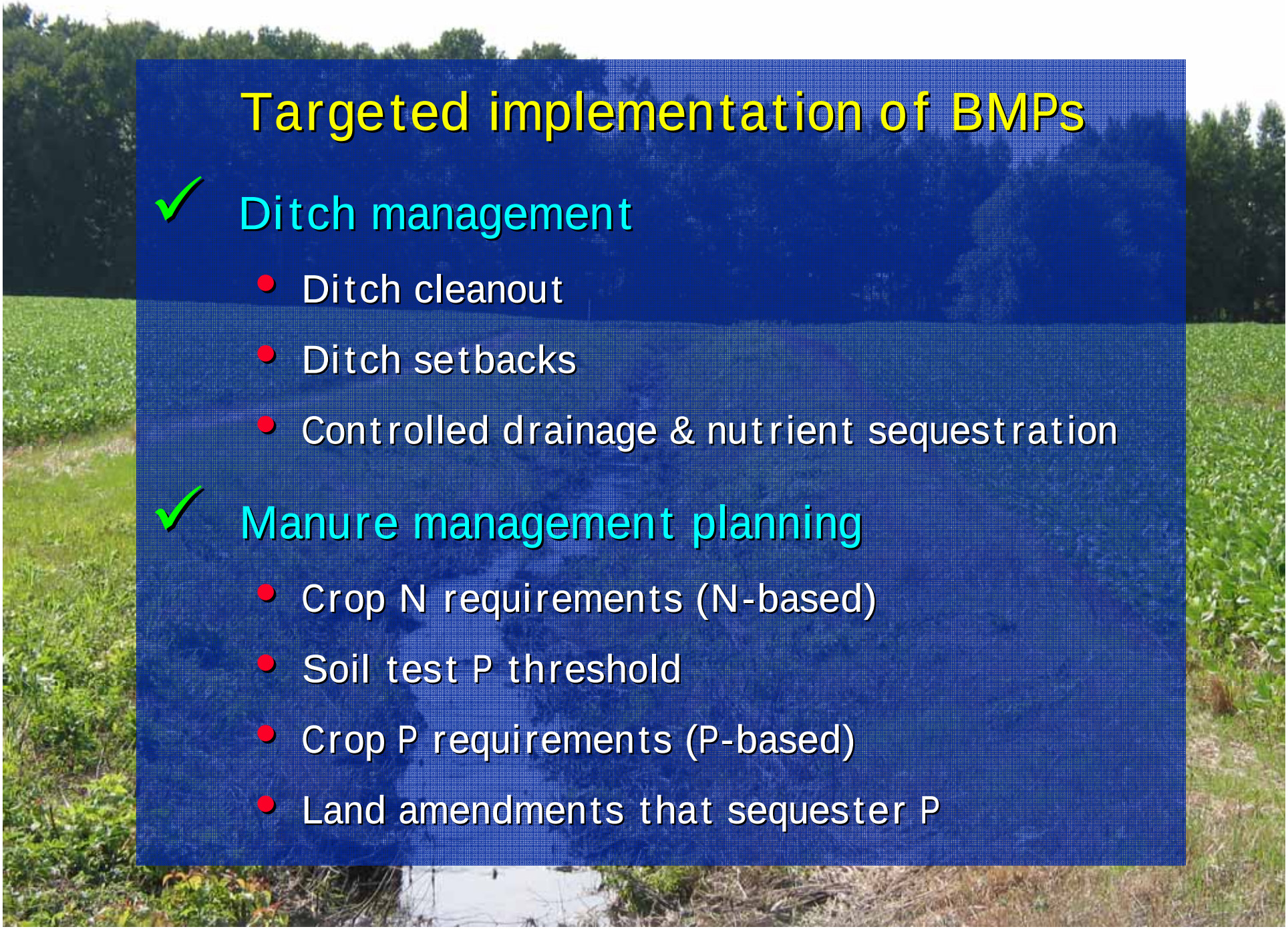
Impact on P export




Riparian buffer

Watershed locations





Targeted implementation of BMPs

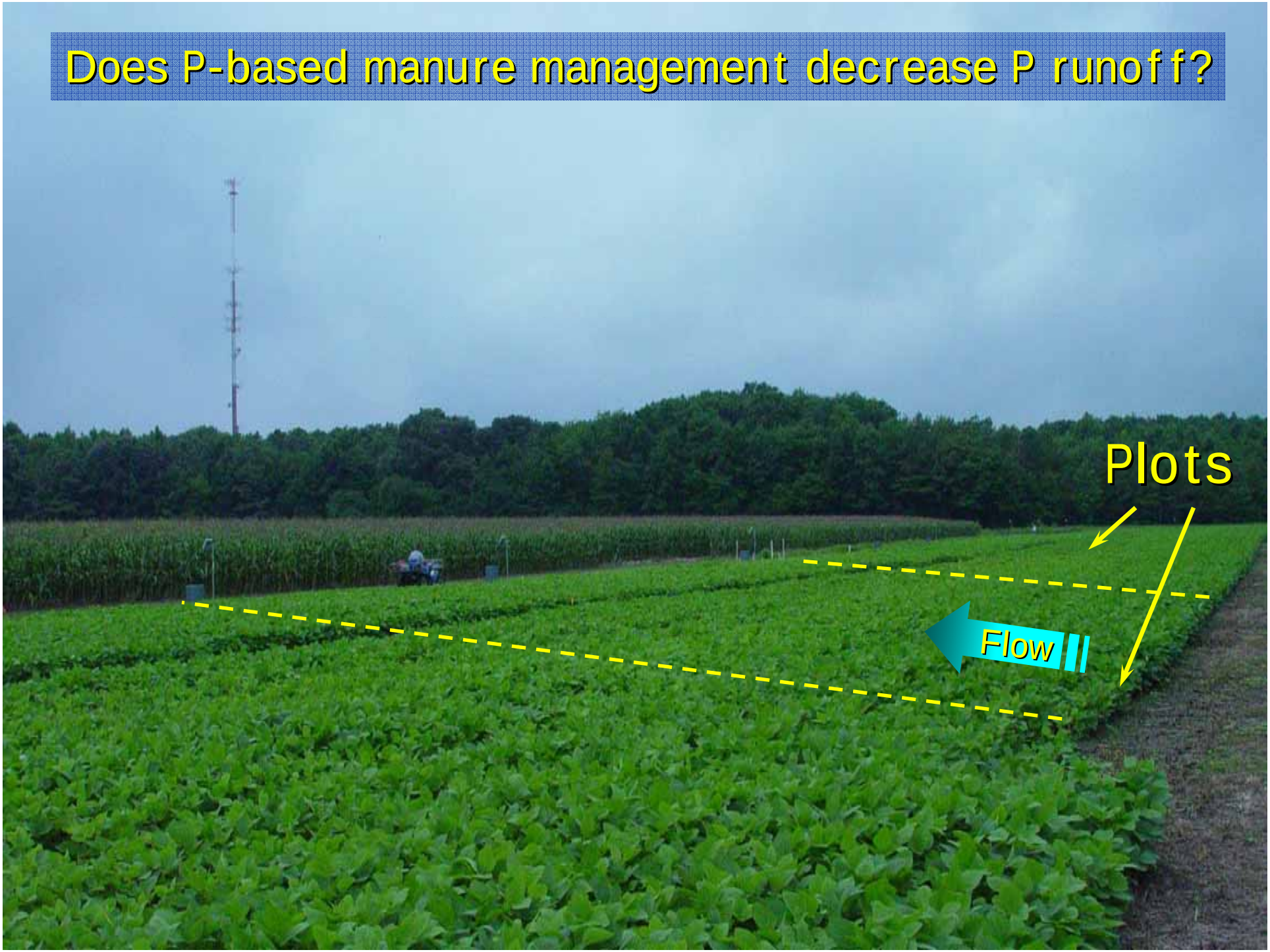
✓ Ditch management

- Ditch cleanout
- Ditch setbacks
- Controlled drainage & nutrient sequestration

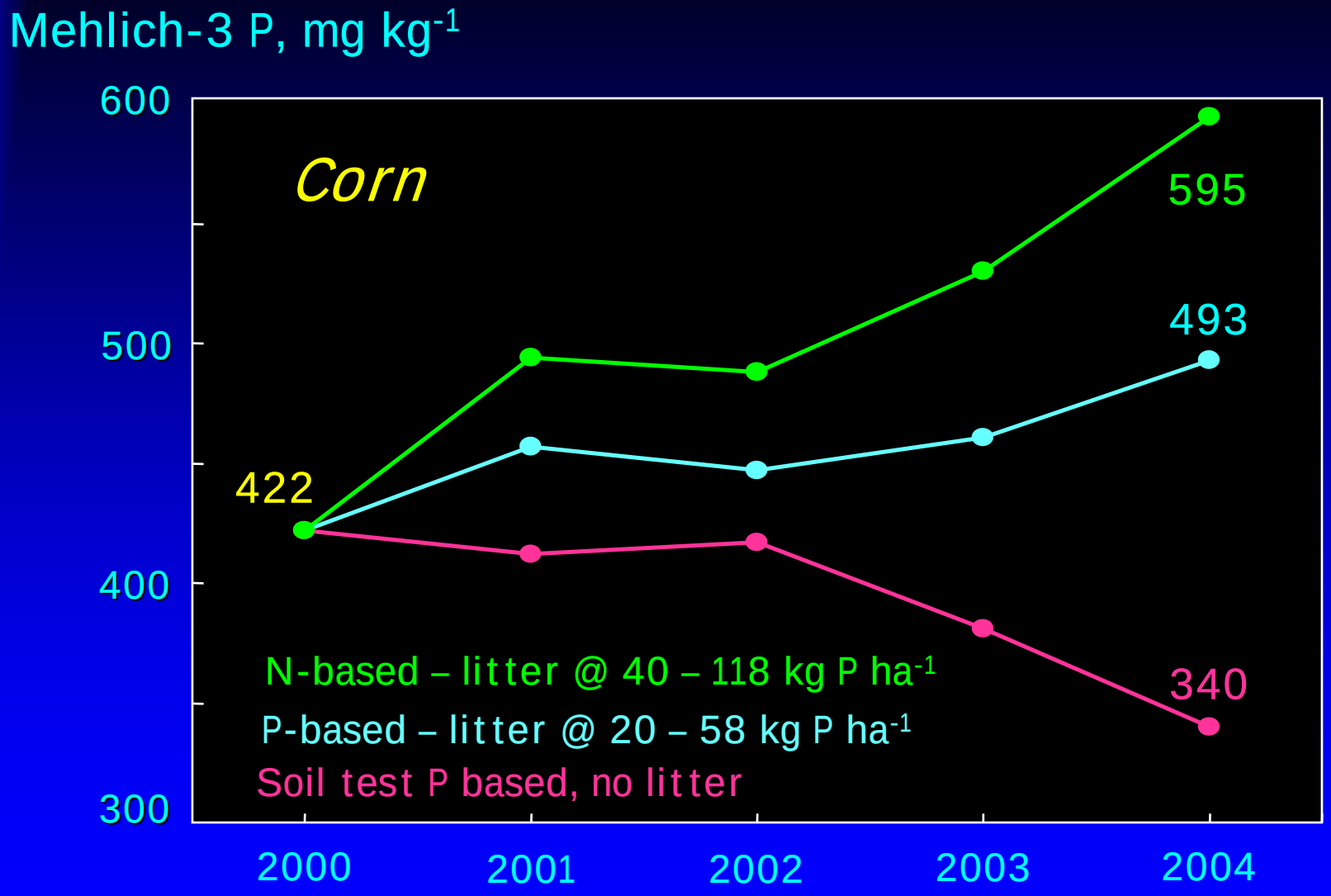
✓ Manure management planning

- Crop N requirements (N-based)
- Soil test P threshold
- Crop P requirements (P-based)
- Land amendments that sequester P

Does P-based manure management decrease P runoff?



Change in Mehlich-3 with time



Effect of different litter mgt. strategies

After 5 years, crop yield not affected by mgt. strategy

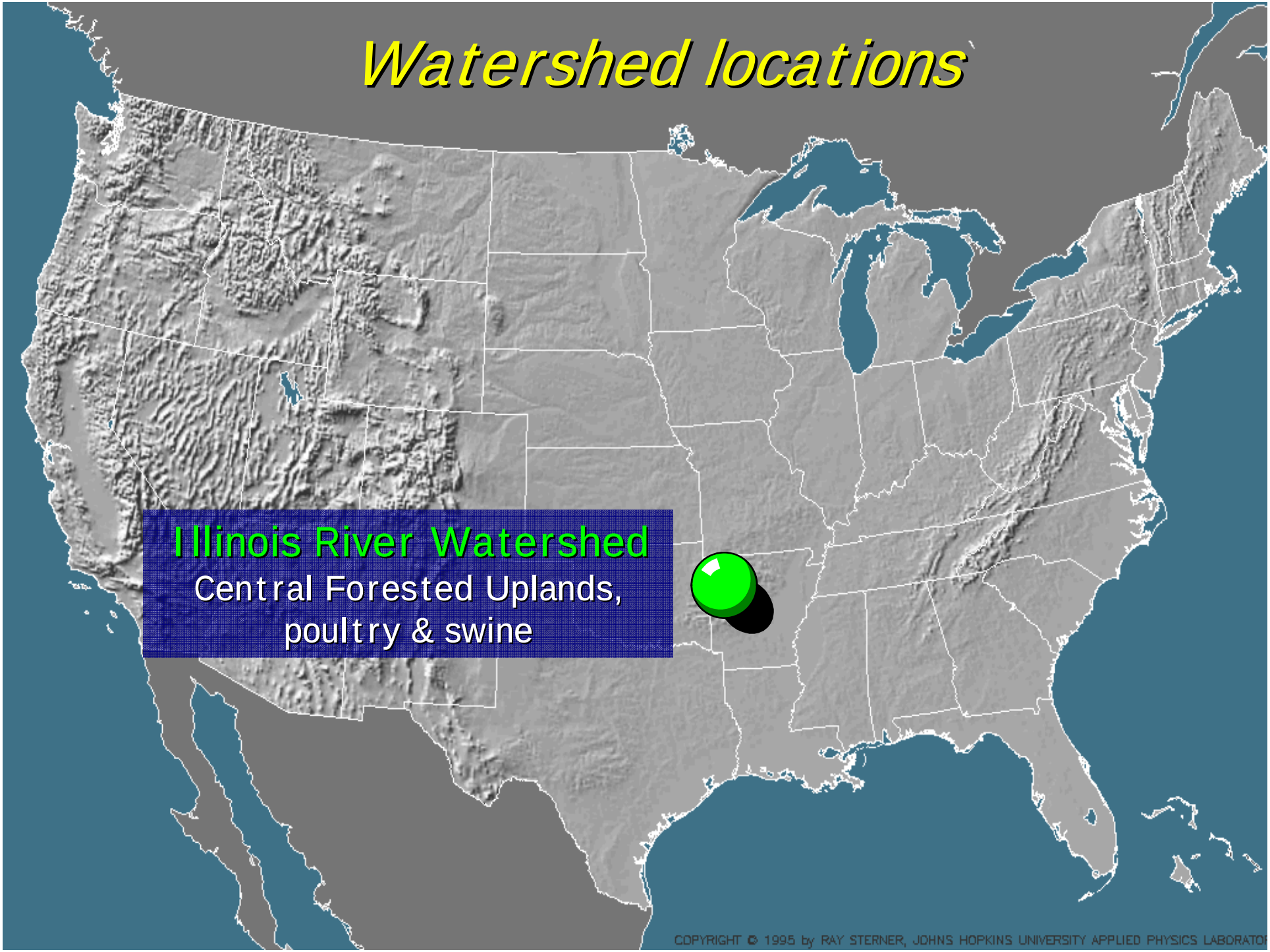
Corn			Soybean		
Soil P	P-based	N-based	Soil P	P-based	N-based
bushels acre^{-1}					
115	120	122	35	36	36

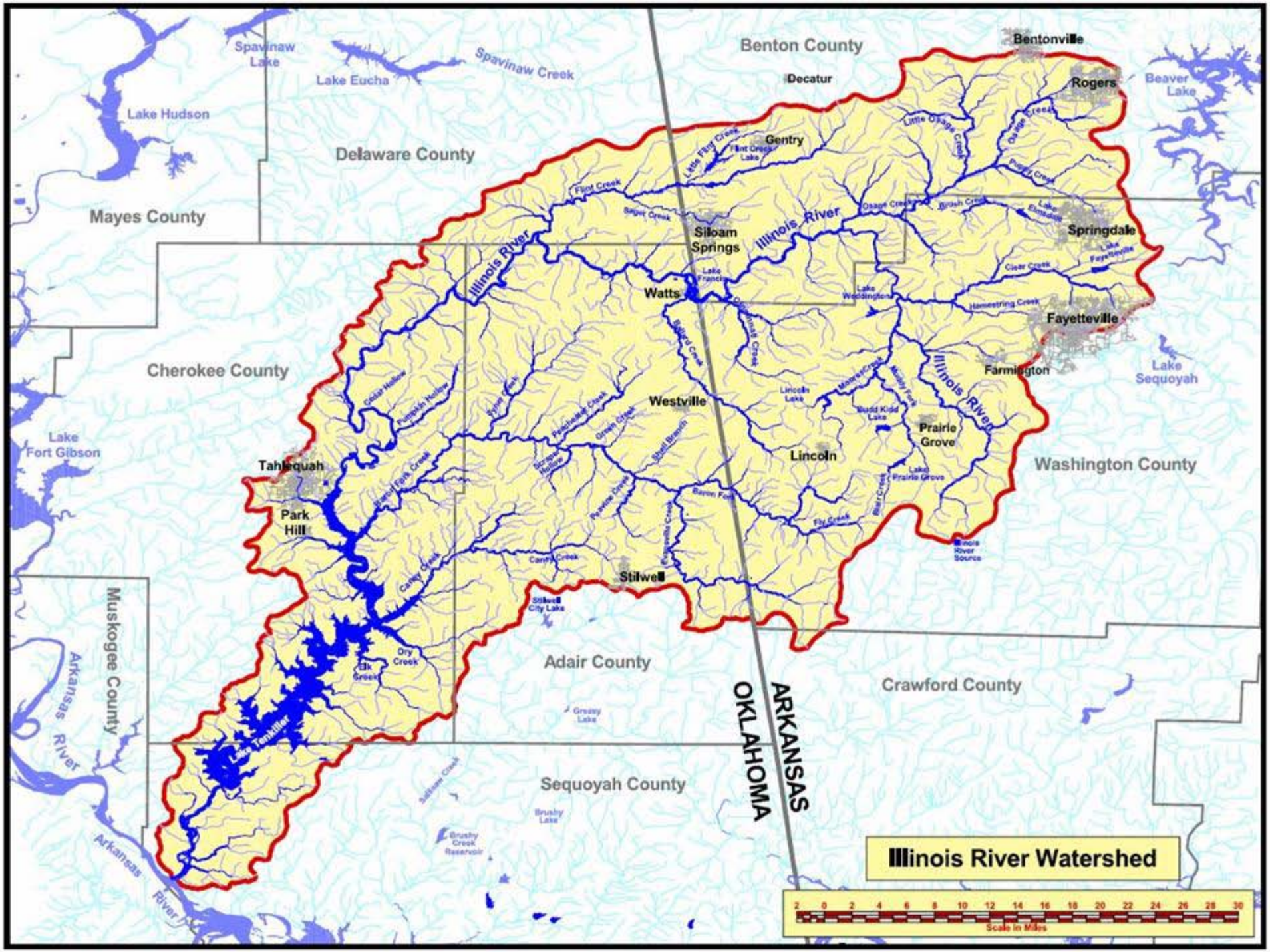
Effect of different litter mgt. strategies

After 5 years, P runoff increased in the order soil P, P-based, and N-based litter

	Dissolved P			Total P		
	Soil P	P-based	N-based	Soil P	P-based	N-based
P concentration, mg L^{-1}						
	0.39	1.40	4.25	0.88	1.85	4.70

Watershed locations




Benton County
Bentonville
Rogers
Decatur
Gentry
Beaver Lake
Spavinaw Lake
Lake Eucha
Spavinaw Creek
Lake Hudson
Delaware County
Mayes County
Siloam Springs
Illinois River
Springdale
Watts
Fayetteville
Cherokee County
Farmington
Lake Sequoyah
Westville
Lincoln
Prairie Grove
Lake Fort Gibson
Tahlequah
Washington County
Park Hill
Stilwell
Muskogee County
Adair County
Crawford County
OKLAHOMA
ARKANSAS
Arkansas River
Sequoyah County
Illinois River Watershed
Scale in Miles

Illinois River Watershed

- ✓ Dominated by broiler poultry and swine operations
  - Exporting 72% (65K tons or ~1.7 million lbs of P)
  - Beef cattle producers losing ~$40K per year
- ✓ River is top recreation & tourism attraction
  - Designated Outstanding Resource Water, Wild & Scenic River
  - Feeds Tenkiller Lake, most popular recreation lake in OK
  - Ultimately drains into Gulf of Mexico

Illinois River Watershed

Targeted implementation of BMPs

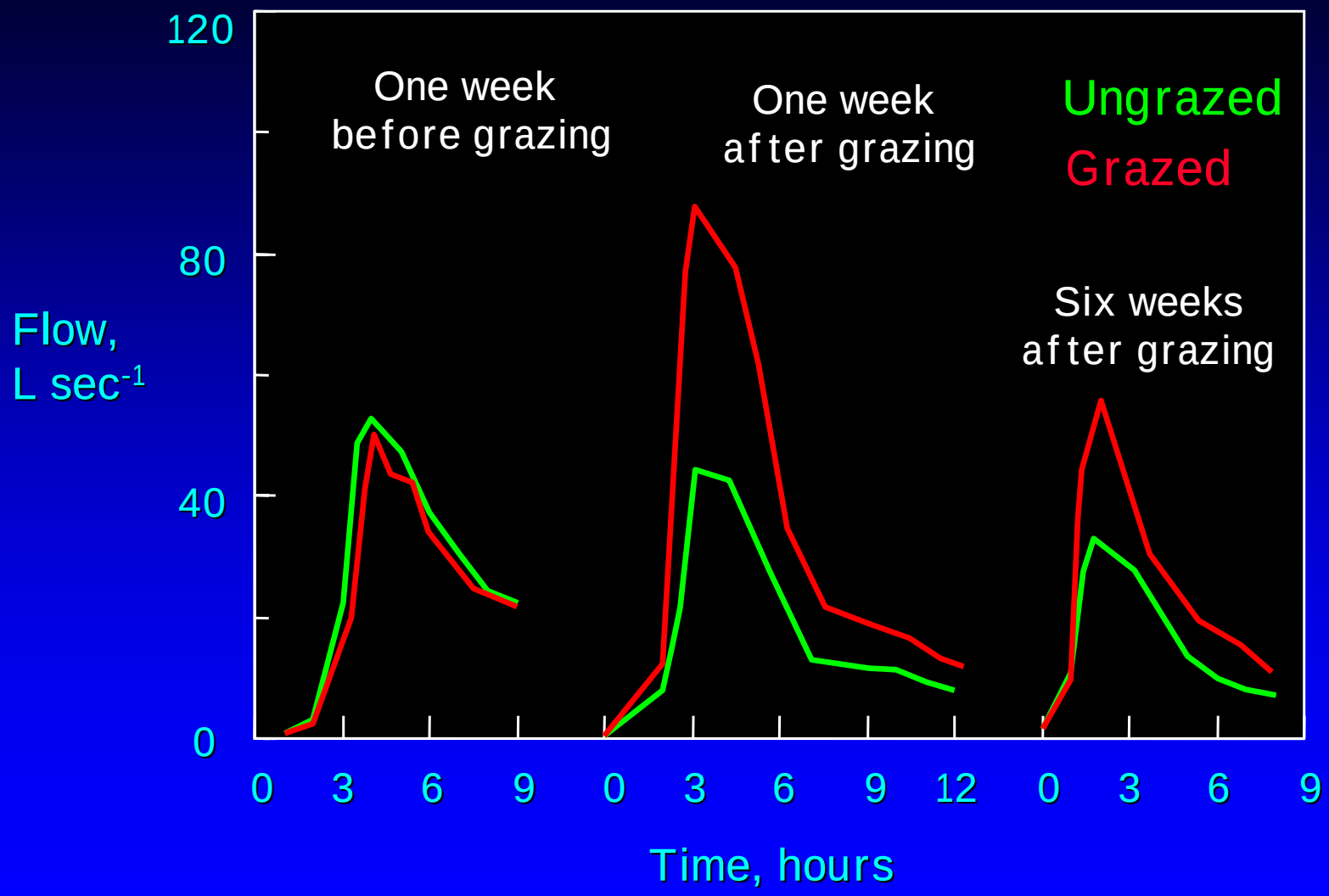
- ✓ Land management
  - Manure treatment & application

Illinois River Watershed

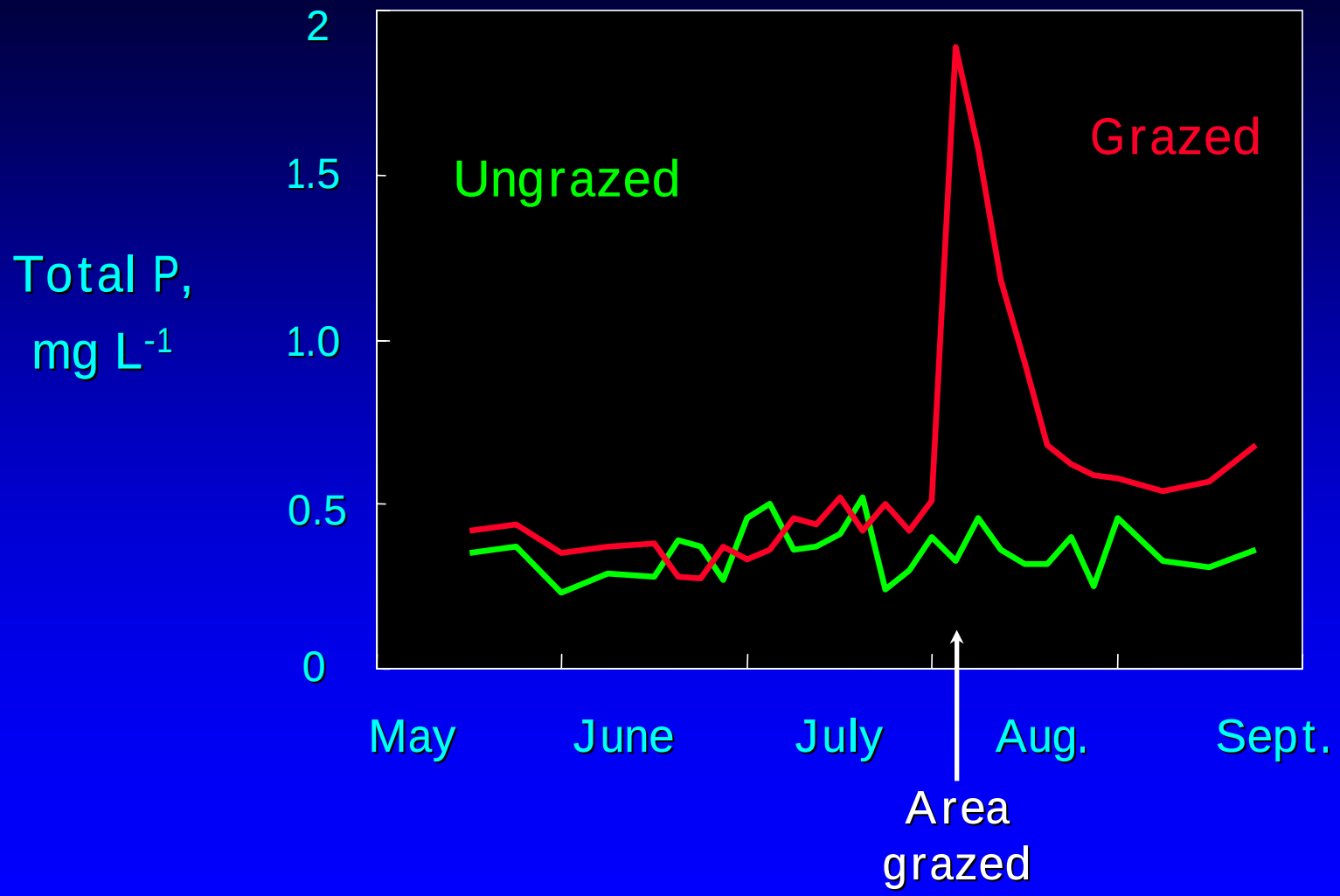
Targeted implementation of BMPs

- ✓ Land management
  - Manure treatment & application
  - Rotational grazing

Grazing and runoff volume



Grazing and runoff P



Illinois River Watershed

Targeted implementation of BMPs

- ✓ Land management
  - Manure treatment & application
  - Rotational grazing
- ✓ Stream exclusion
- ✓ Riparian buffers
- ✓ Conservation Reserve Enhancement Program
- ✓ Transport litter out of watershed


✓ Stream-bank and riparian area improvement
✓ Enhanced wildlife diversity & stream health
✓ Increased stream channel meandering
✓ Reduced stream bank erosion
✓ However,
• Farmers can be reluctant to take land out of production
• Cost
• Several agencies involved in approval and installation
• Mountain of paperwork for the farmer

Targeting BMPs - Differences and Similarities

Cannonsville, NY	Manokin, MD	Illinois, AR/OK
Diet modification	Diet modification	Diet modification
Manure treatment	Manure treatment	Manure treatment
Manure management	Manure management	Manure management
Reduced tillage	Crop rotation	Pasture management
Crop rotation	Controlled drainage	Stream exclusion
Cover crops	Ditch setback	Riparian buffers
Stream exclusion		
Riparian buffers		

Conclusions

- ✓ Fewer BMP options & limited land base for manure in
  - Subsurface flow & shallow water table in Manokin watershed
  - Pasture-based Illinois River watershed
- ✓ Farmers must be see benefits of BMPs
  - Local as well as regional (i.e., farm & Gulf or Bay)
- ✓ Must consider unintended or indirect consequences
  - Conservation / conventional till – change in transport pathways
  - Biofuel – distillers grain for feed has high P (~0.9%)
- ✓ Strategies should maintain flexibility of farm mgt.
- ✓ Pressures external to farm can dictate remedial success