

# **Contaminant Source and Watershed Characterization Data Needs**

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**Gregory McIsaac, Robert Howarth, and Richard B. Alexander**  
**Univ. of Illinois      Cornell Univ.      USGS**

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# Contaminant source and watershed data needed for effective water quality modeling

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## Contaminant Sources

- Point source discharges

- Non-point sources

  - Atmospheric deposition

  - Erosion, fertilizers and pesticides

  - Livestock wastes

  - Biological N fixation

## Watershed Characteristics

- Land cover and management practices

- Topography

- Soils

- Precipitation

- Hydrology: surface and sub-surface discharges

- Hydraulics: flow paths and residence times

# Integrating Databases

Various efforts underway

USGS: SARROW model

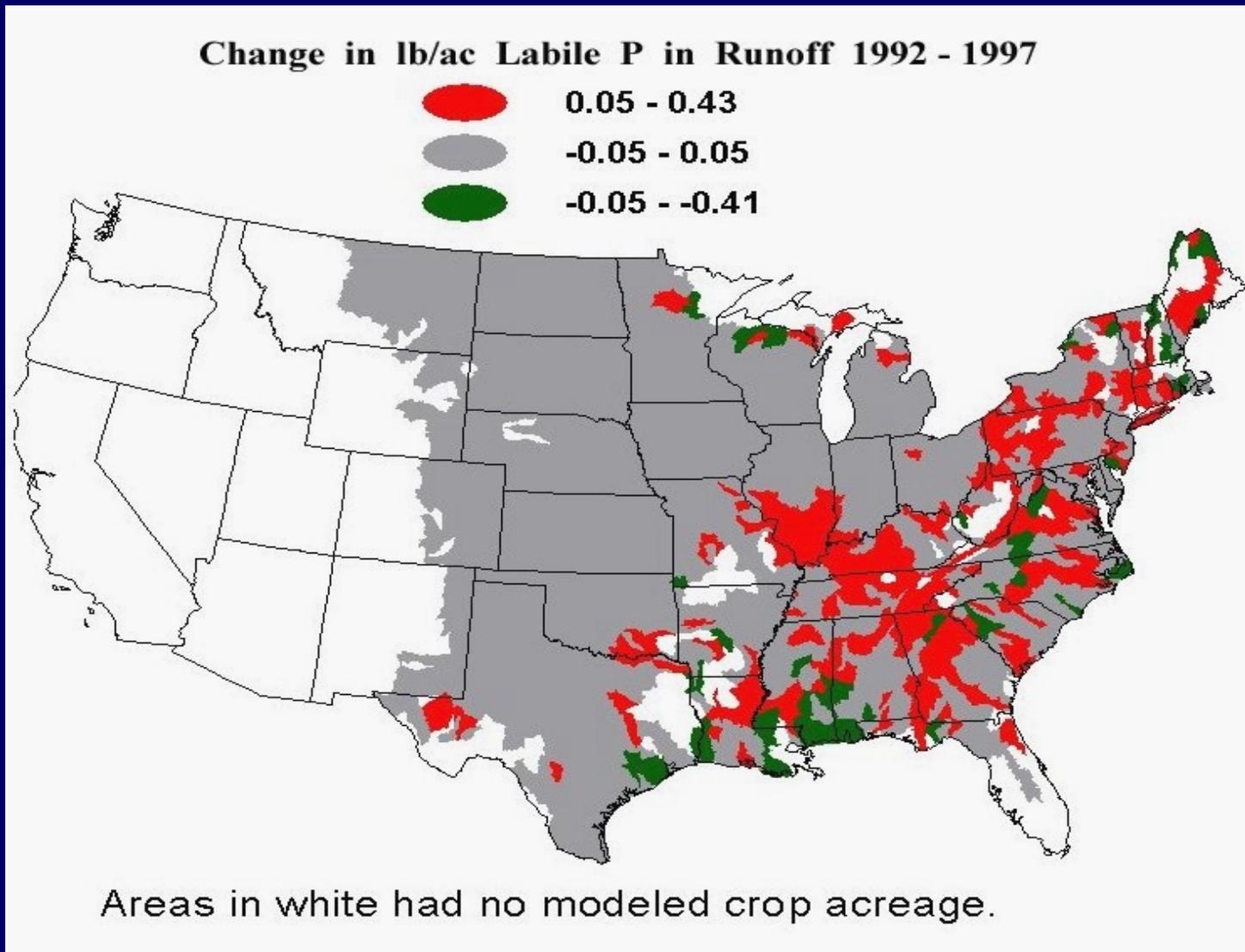
USDA-NRCS EPIC modeling with NRI and Census of Ag Data

USDA-ARS: SWAT model

CENR effort for the Mississippi River Basin (Goolsby et al)

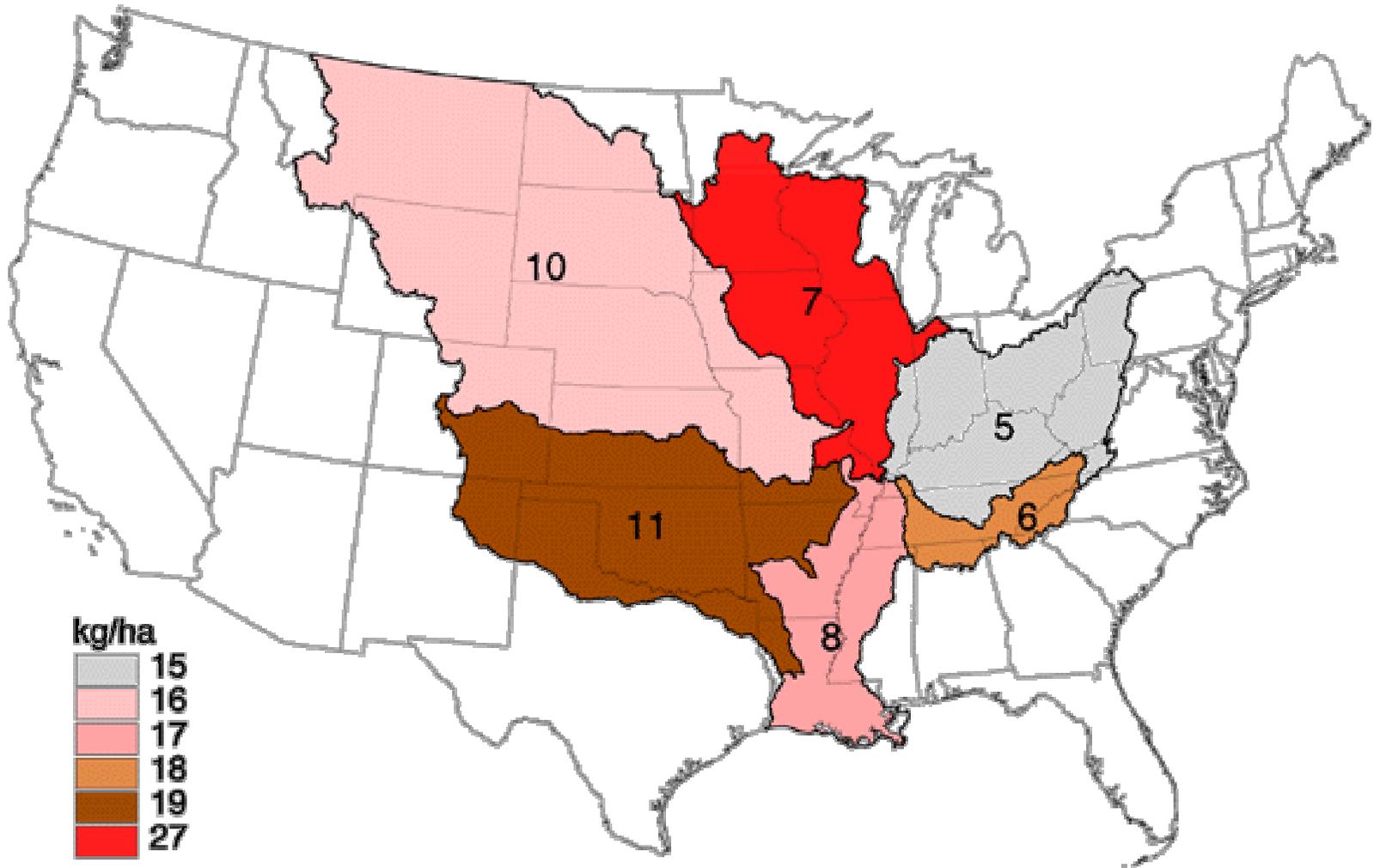
USDA-ARS: Miss. R. Basin N budgeting by Burkart and James.

# **NRI Data Modeled with EPIC: Change in average Labile P in Runoff 1992-97 due to Changes in Crop Mix, manure not considered** **(by Atwood, Kellogg, Lemunyon, Potter and Pitts USDA-NRCS and TX Ag Exp. Station)**

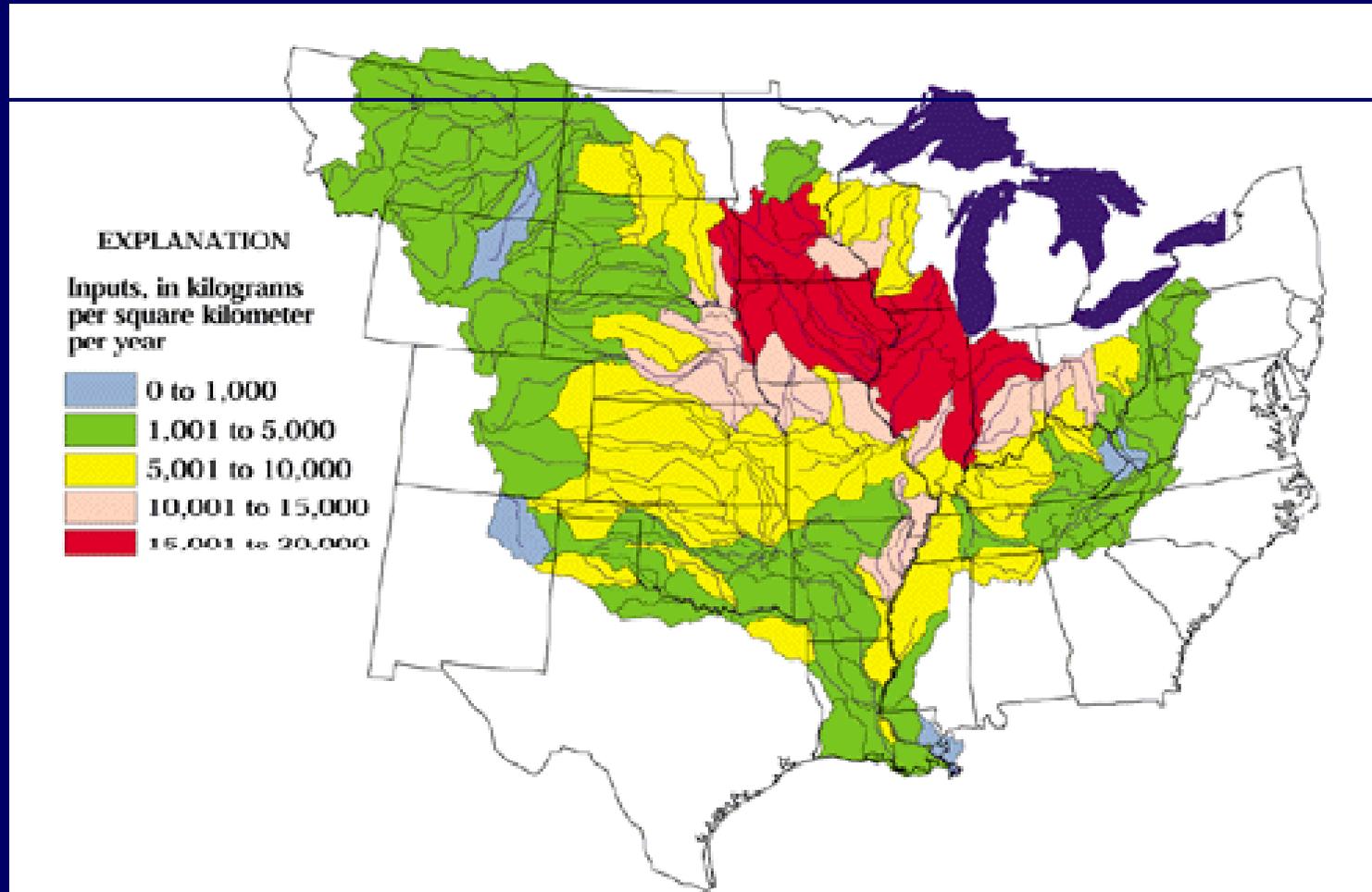


# N inputs – N outputs by Basin for 1992 (Burkart and James, 1999)

Figure 16. Excess nitrogen contributions by hydrologic region



# 1980-96 Average Annual Total N inputs: Fertilizer, Fixation, Manure, Atmospheric, Deposition, Cropland Soil Mineralization (Goolsby and Battaglin, 2000)



# Proposed National Nutrient Accounting System

Interagency effort to compile nutrient input and output estimates on a consistent national basis for:

- model evaluation and comparison
- targeting monitoring and research
- guide conservation efforts

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# Point Source Discharges

EPA National Pollutant Discharge Elimination System  
(NPDES)

Designed for avoiding problems caused by point  
discharges,  
not designed for monitoring of actual loads discharged

# Non-Point Sources: Atmospheric Deposition

## Wet deposition

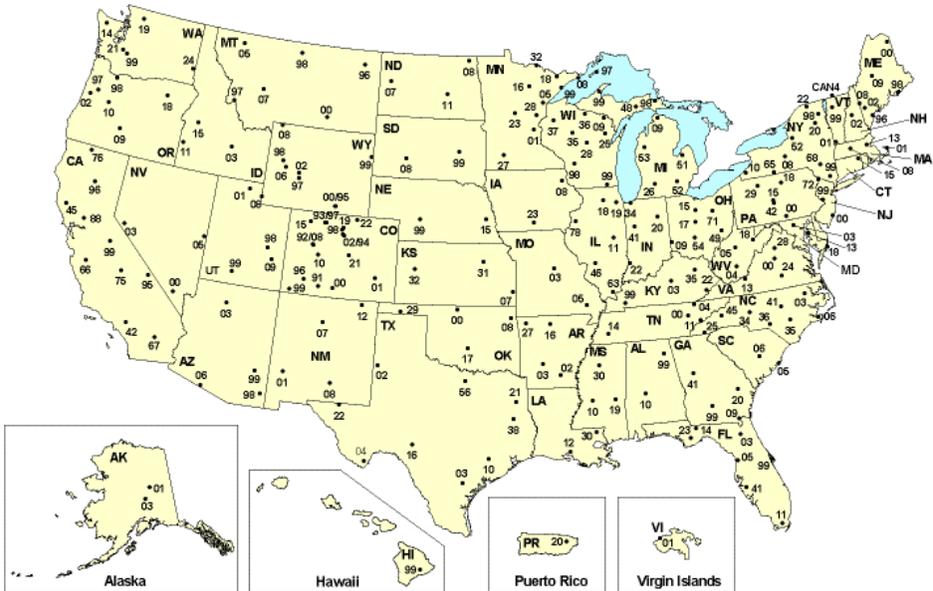
National Atmospheric  
Deposition Program  
(NADP)

## Dry Deposition

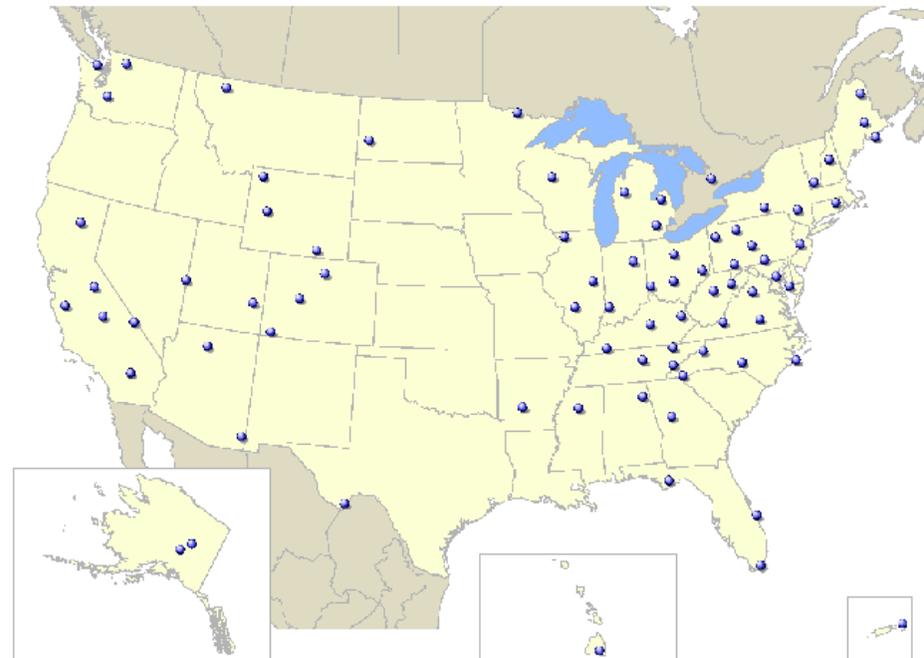
Clean Air Status and  
Trends Network  
(CASTNET)

## Current Monitoring Locations

National Atmospheric Deposition Program  
National Trends Network



CASTNET



# Non-point sources: Fertilizers

Sales and Survey data

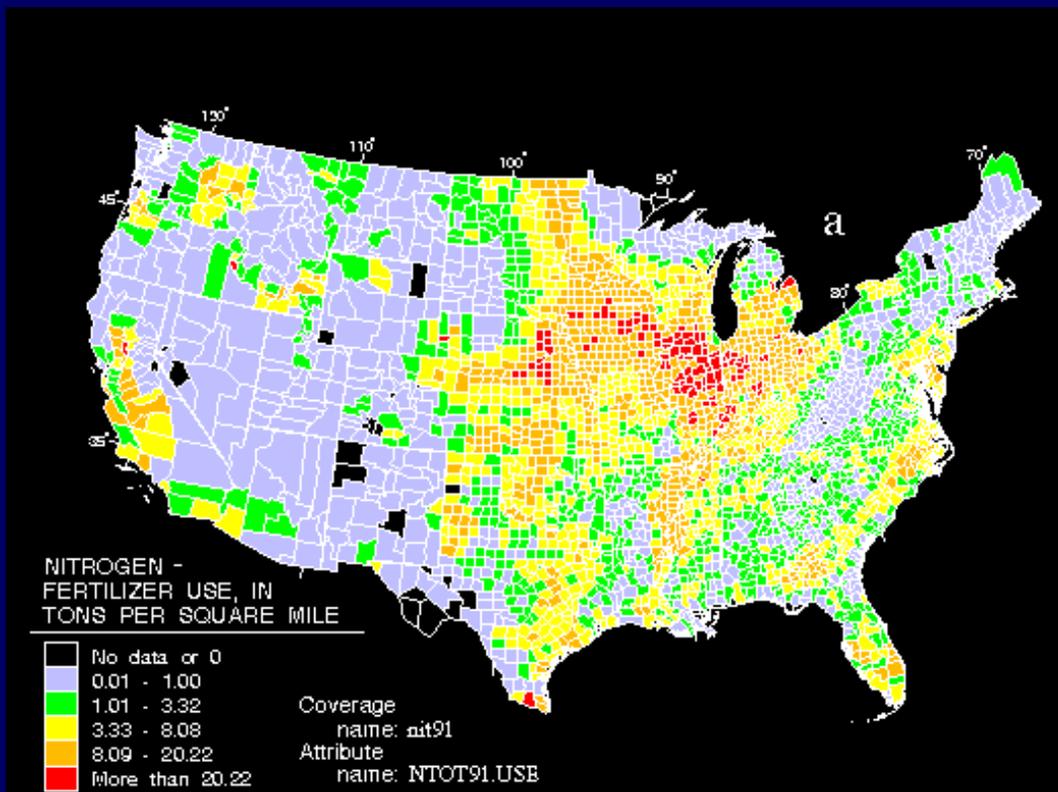
# Non-point sources: Fertilizer

## Sales data by state

Assoc. of Am. Plant Food Control Officials (AAPFCO)

County level sales for some states

County level estimates of sales developed by USGS



Estimated N fertilizer use  
per county for the 1991 crop  
year

(Battaglin and Goolsby,  
1994)

# Non-point sources: Fertilizer

Survey data

USDA-ERS annual surveys for major crops in states where production is concentrated

Surveys are costly and sampling is often sufficient for state level aggregation only

Until recently, information on recommended levels of fertilizer application or timing of application were not collected.

## Non-point sources: Pesticides

USDA annual surveys by crop and state

National Center for Food and Agriculture Policy  
compilations of national and state data

Census of Agriculture expenditures on agri-chemicals

USGS county level estimates

## Non-point sources: Livestock Wastes

Annual state and county livestock inventory and production estimates statistics from USDA-NASS

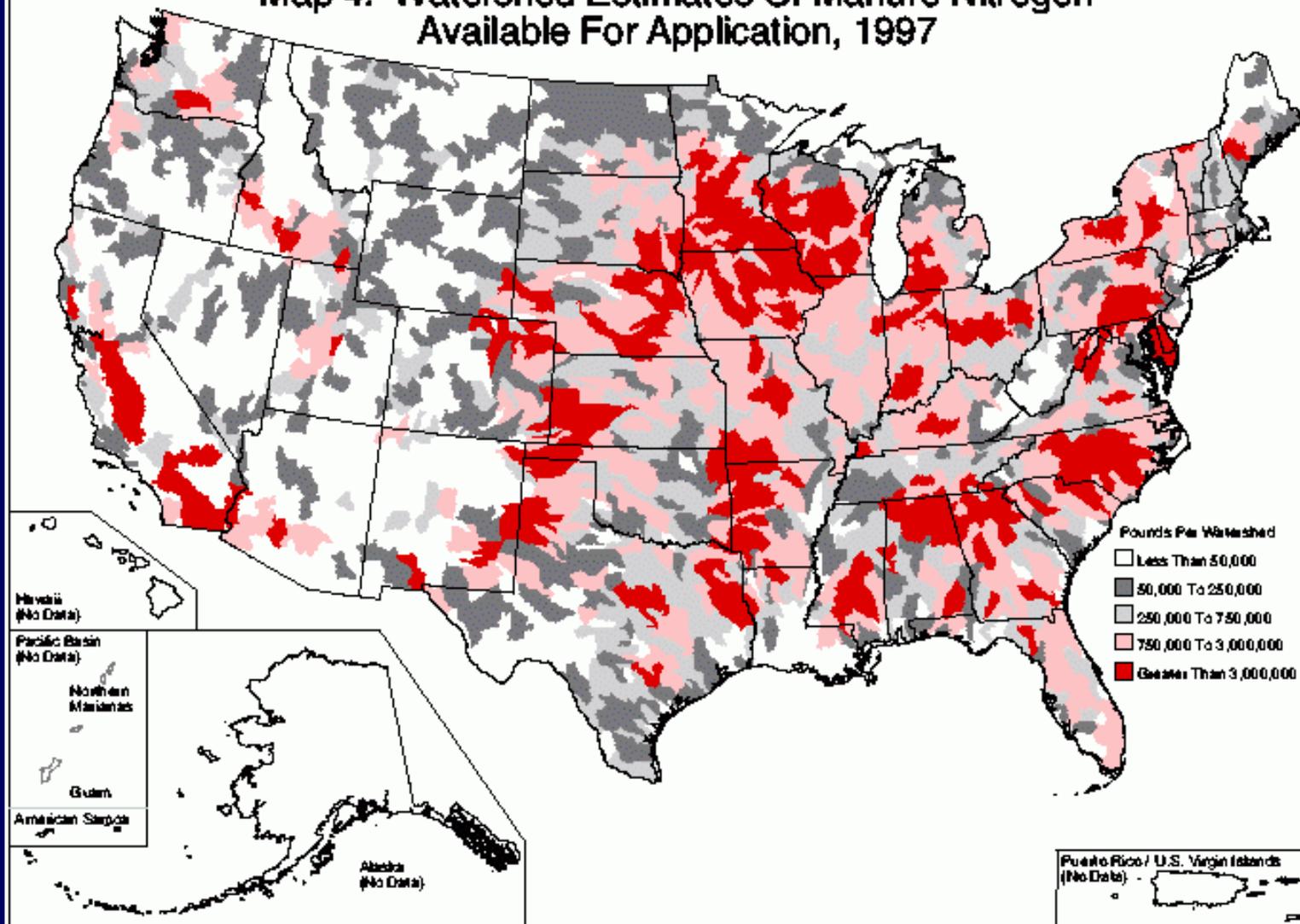
More extensive data collection from the Census of Agriculture every 5 years.

Waste volume and nutrient content are estimated from generalized relationships for species and age classes.

Recent experiments indicate that waste characteristics can vary considerably with diet.

Impacts on water quality will depend on animal and manure handling practices and proximity to water bodies.

Map 4. Watershed Estimates Of Manure Nitrogen Available For Application, 1997



U.S. Department of Agriculture  
Natural Resources Conservation Service  
Resource Assessment Division  
Washington, D.C. November 2000

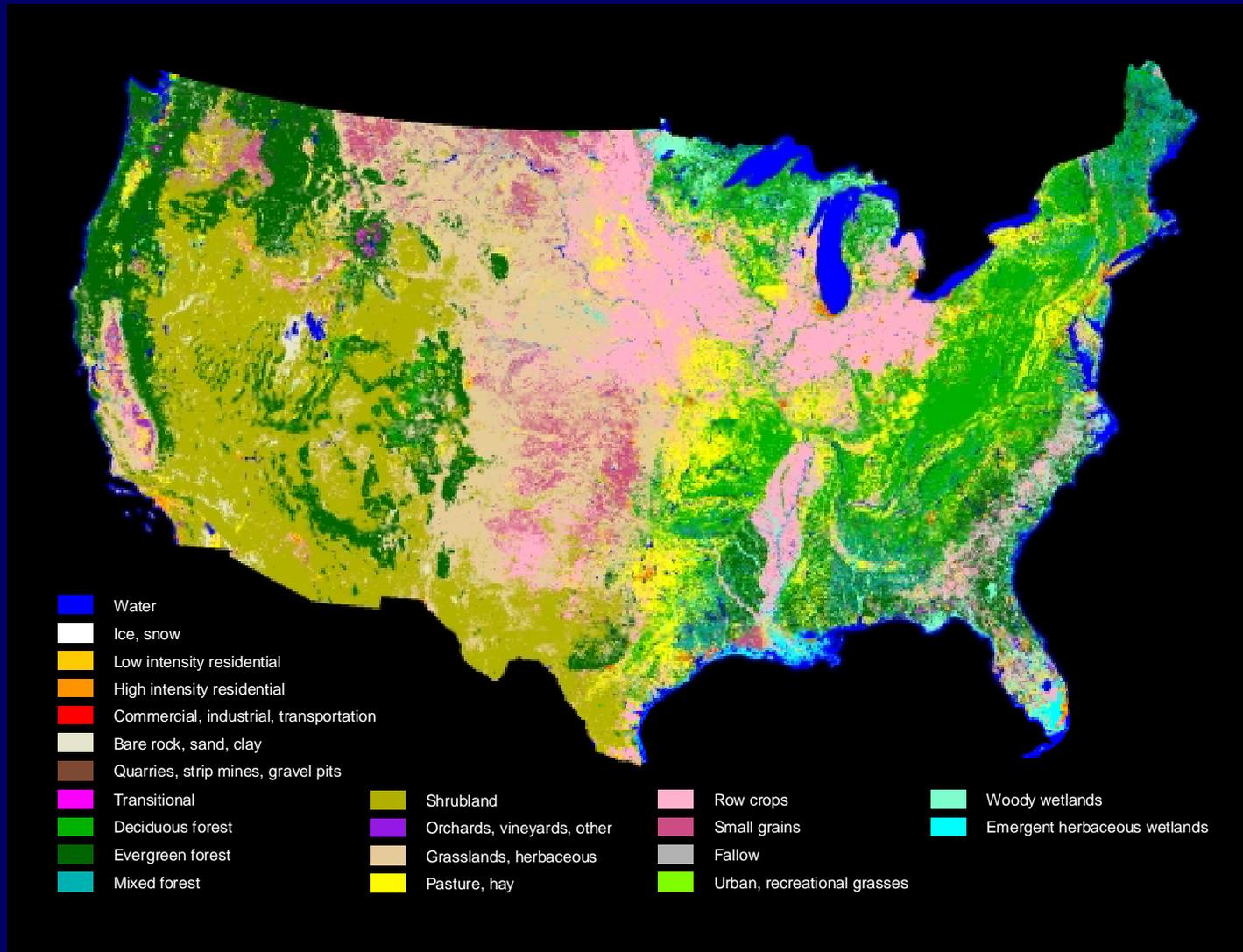
Map ID: m5261

Robert L. Kellogg, 2000, based on Census of Agriculture

# Land cover

National Land Cover Data (NLCD)

From Schwarz, USGS, 2001



# Land cover

## Satellite Imagery:

there are some errors in classification

difficulties distinguishing annually planted crops from hay  
and pasture

## USDA-National Resource Inventory

Survey of a sampling of fields every 5 years to estimate soil erosion

## USDA Census of Agriculture

Anonymous surveys, precise location cannot be reconstructed

# Topography

USGS DEMs at 30 m resolution available for most of USA

10 m resolution in progress in some locations.

May still be too coarse for flat regions in portions of Illinois, Ohio & Michigan where tile drainage is common.

# Soils

Soil Survey

STATSGO ~1 km resolution

Finer resolution data are available, but not yet in digital form for most locations

## Hydrology: discharge

Daily and 15 minute discharge from USGS gauges

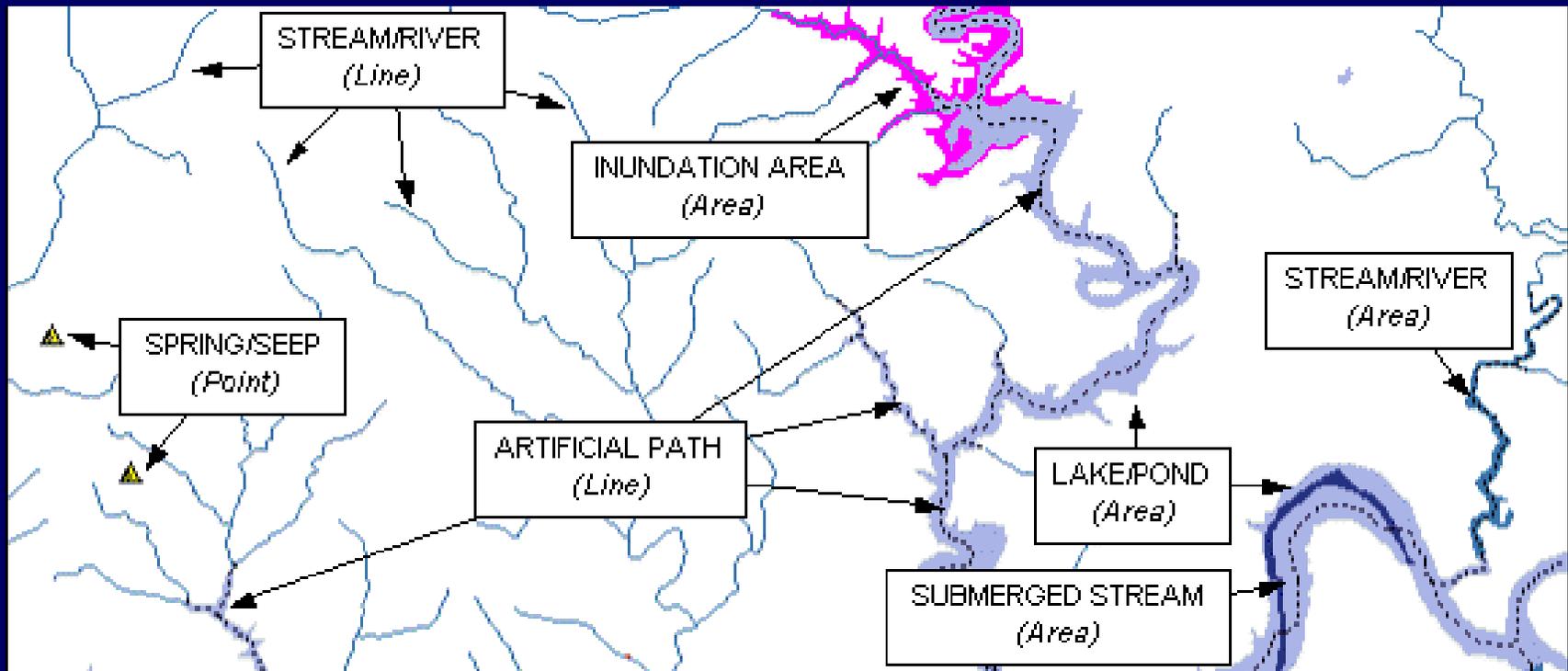
High quality data.

Mostly large basins where there are multiple influences.

Few stations in coastal areas.

# Hydrology: flow paths and residence times

## EPA and USGS National Hydrography Dataset (NHD)



# Hydrology: flow paths and residence times

EPA and USGS National Hydrography Data (NHD)

1:100,000 scale, designed to accommodate higher resolution

Existing flow network data needs corrections

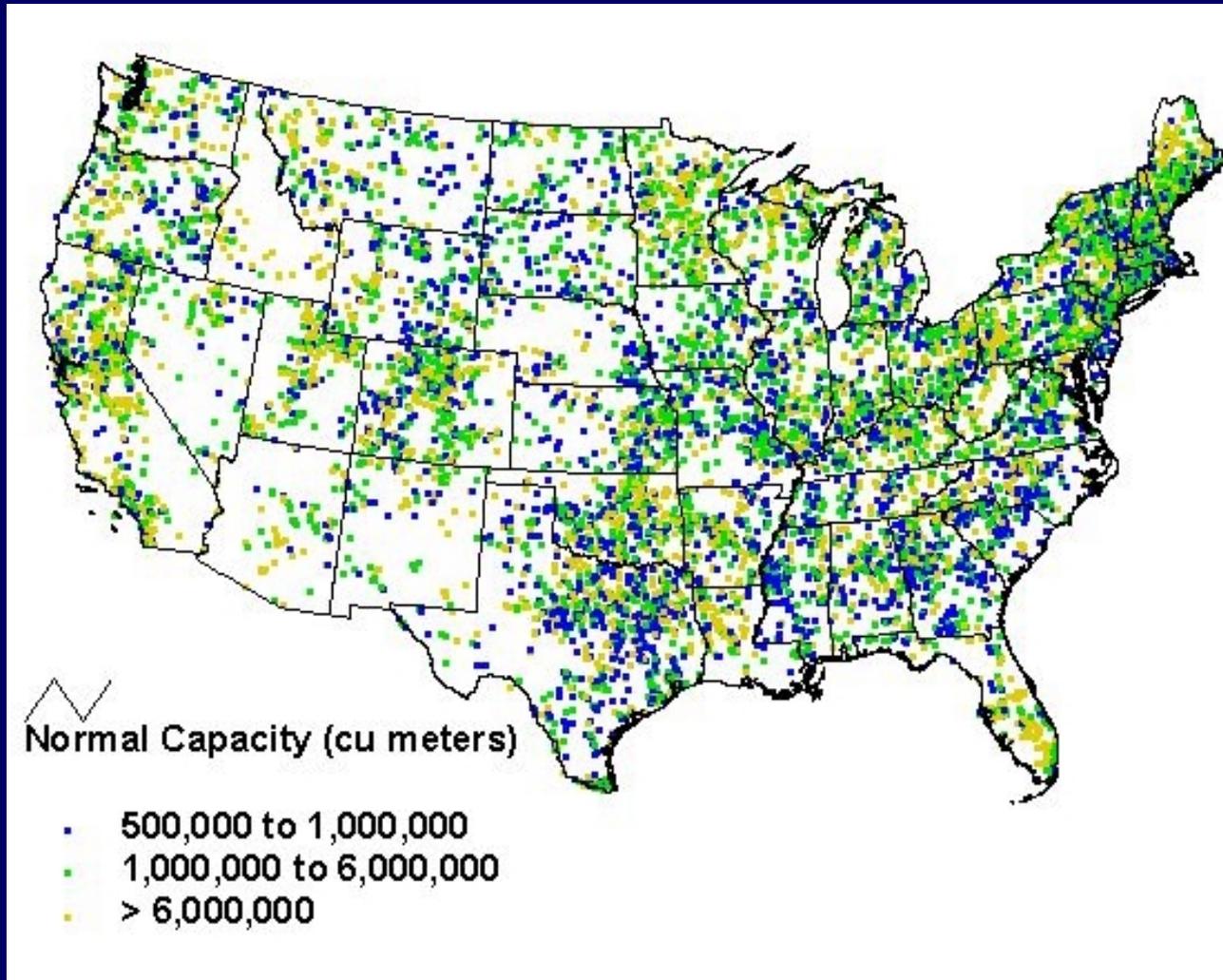
Inconsistent coverage of wetlands, lakes and reservoirs

Need to have correct and consistent coverage of stream density, flow, time of travel and integrate information on National Inventory of Dams (NID) from US ACE.

Does not address tile drainage, which can significantly influence nitrate transport to streams.

# US ACE National Inventory of Dams (NID)

>70,000 Reservoirs, Lakes, Ponds



# Effect of Tile drainage on River N Flux in Illinois

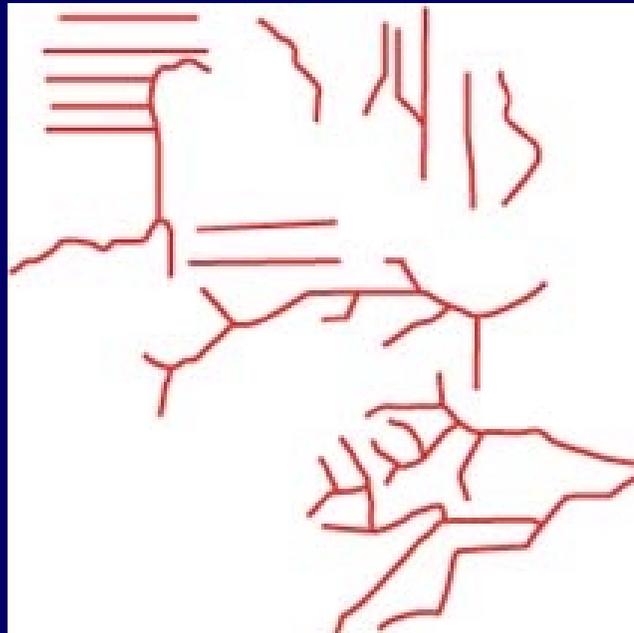
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<u>Region</u>	<u>Tile drainage</u>	<u>Net N Input</u>	<u>River N flux</u>
		----- <u>(kg N/ha-yr)</u> -----	
East Central IL	extensive	27	24
Southern IL	minimal	23	9

Infrared aerial photograph  
east Central IL, prior to  
crop emergence and  
after significant precipitation



Inferred location of  
tile drains



From Zucker and Brown, 1998

# Summary

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Much data is available but there is always room for improvement

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Much data is available but there is a continual need for improvement

Highest priority needs in our opinions:

- Point source loads

- Refined NHD

- Atmospheric Deposition in Urban and Coastal Regions

- Finer resolution of fertilizer use in agricultural regions

- Tile drainage and finer resolution topography in flat areas

- CAFOs and animal waste handling practices

- Higher frequency, nationally consistent land cover that can distinguish between row crops and pasture

- Institutional cooperation for integrating, improving and interpreting data

Thank You.