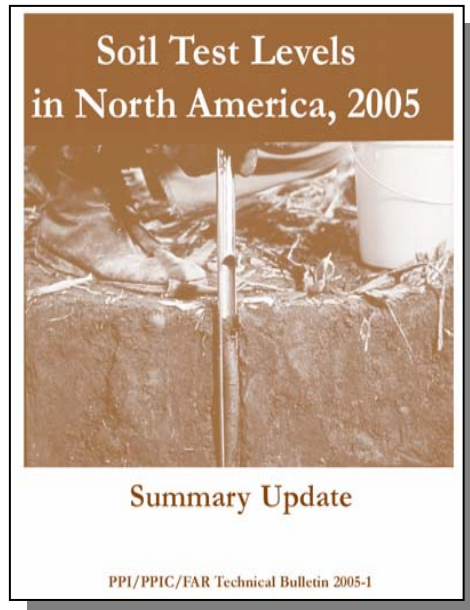


GIS OPPORTUNITIES WITH FERTILIZER USE DATA

Dr. Harold F. Reetz, Jr.
International Plant Nutrition Institute
Foundation for Agronomic Research
Monticello, Illinois

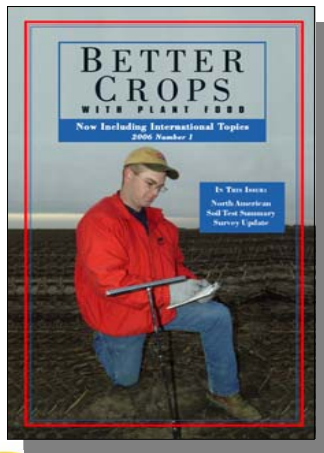


2005 SOIL TEST SUMMARY



Technical summary bulletin:

- 3.4 million soil samples collected for 2005 crop
- 70 cooperating laboratories
- Solid science
- A reference for applied publications & to respond to P and K related issues

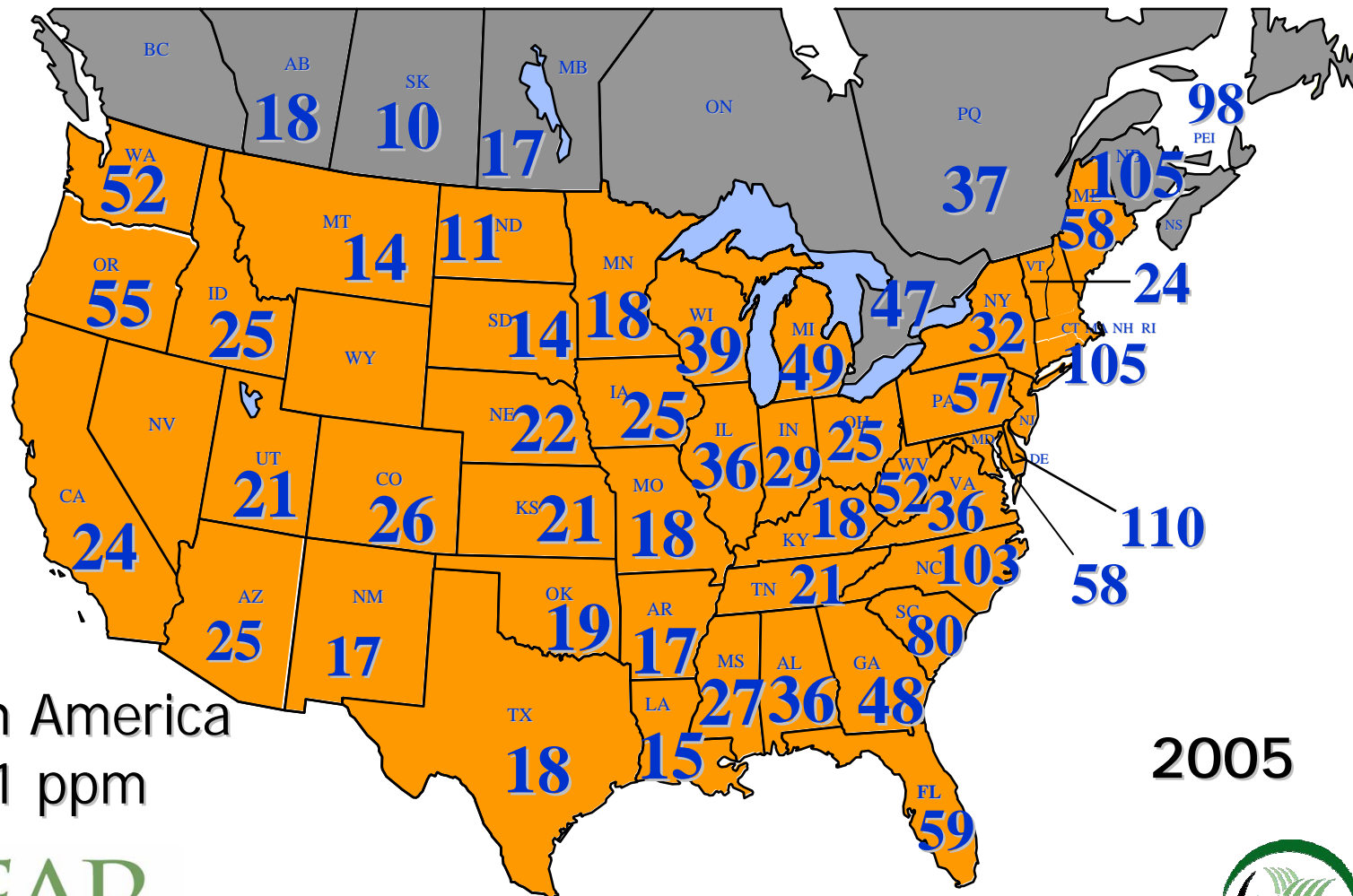


Better Crops 2006(1): regional interpretation

Repackaged for public – non-technical - audiences

MEDIAN BRAY P1 EQUIVALENT, PPM

3.4 million samples

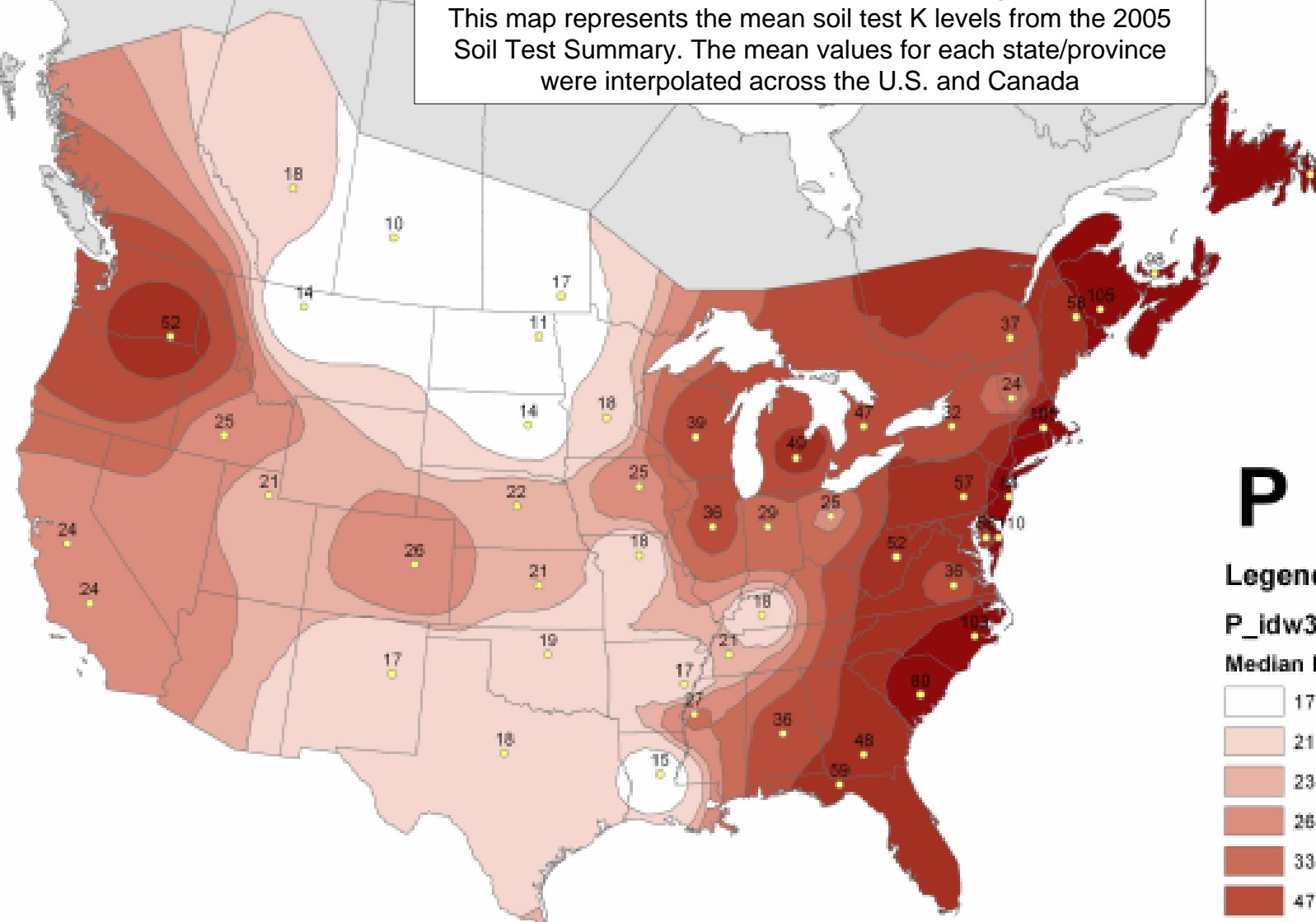


North America
31 ppm

2005

2005 Soil Test Summary P

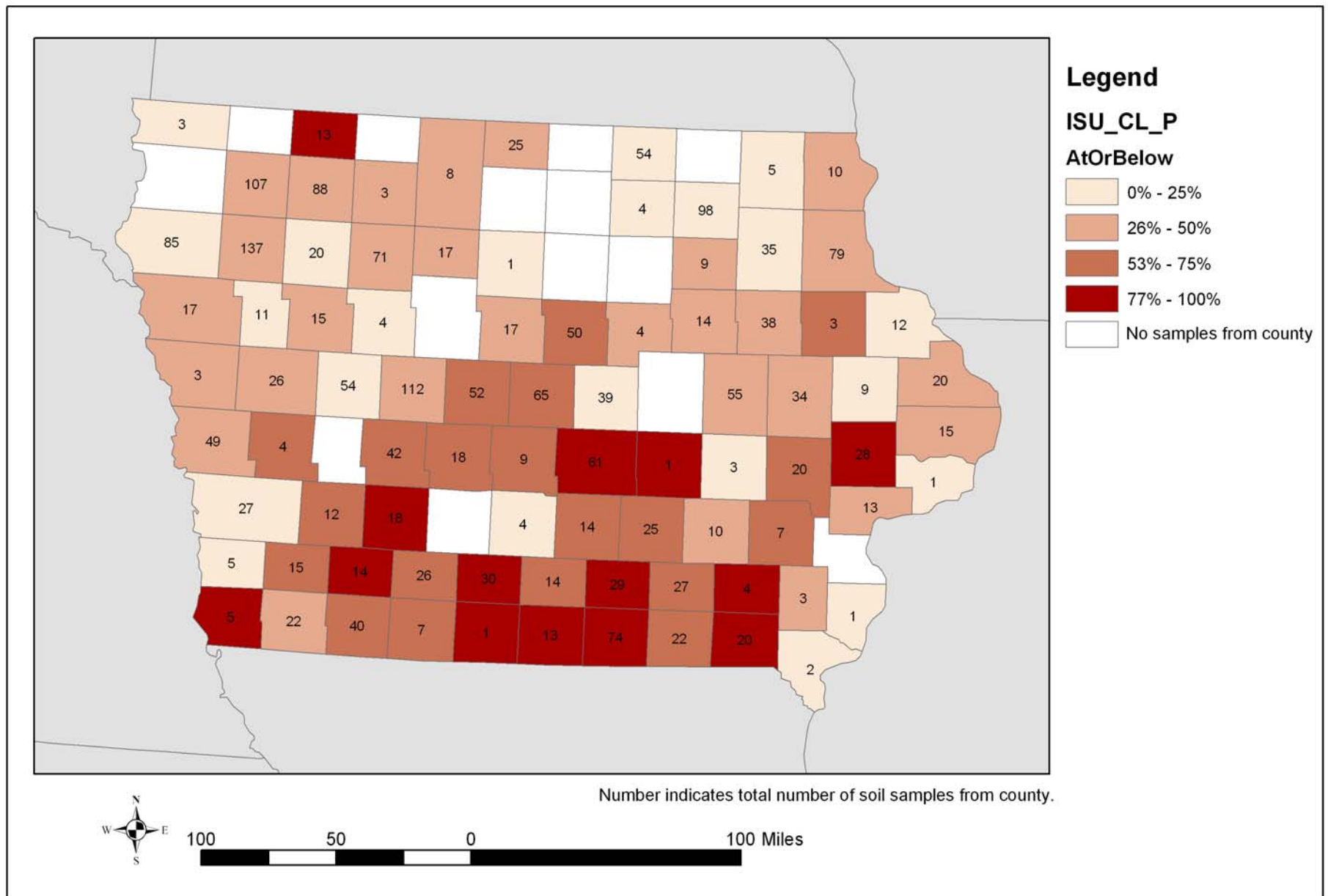
This map represents the mean soil test K levels from the 2005 Soil Test Summary. The mean values for each state/province were interpolated across the U.S. and Canada



Potash & Phosphate Institute
Soil Test Summary 2005

Iowa State University Soil Samples

Percentage of Samples At or Below the University Critical P Value (20 ppm)



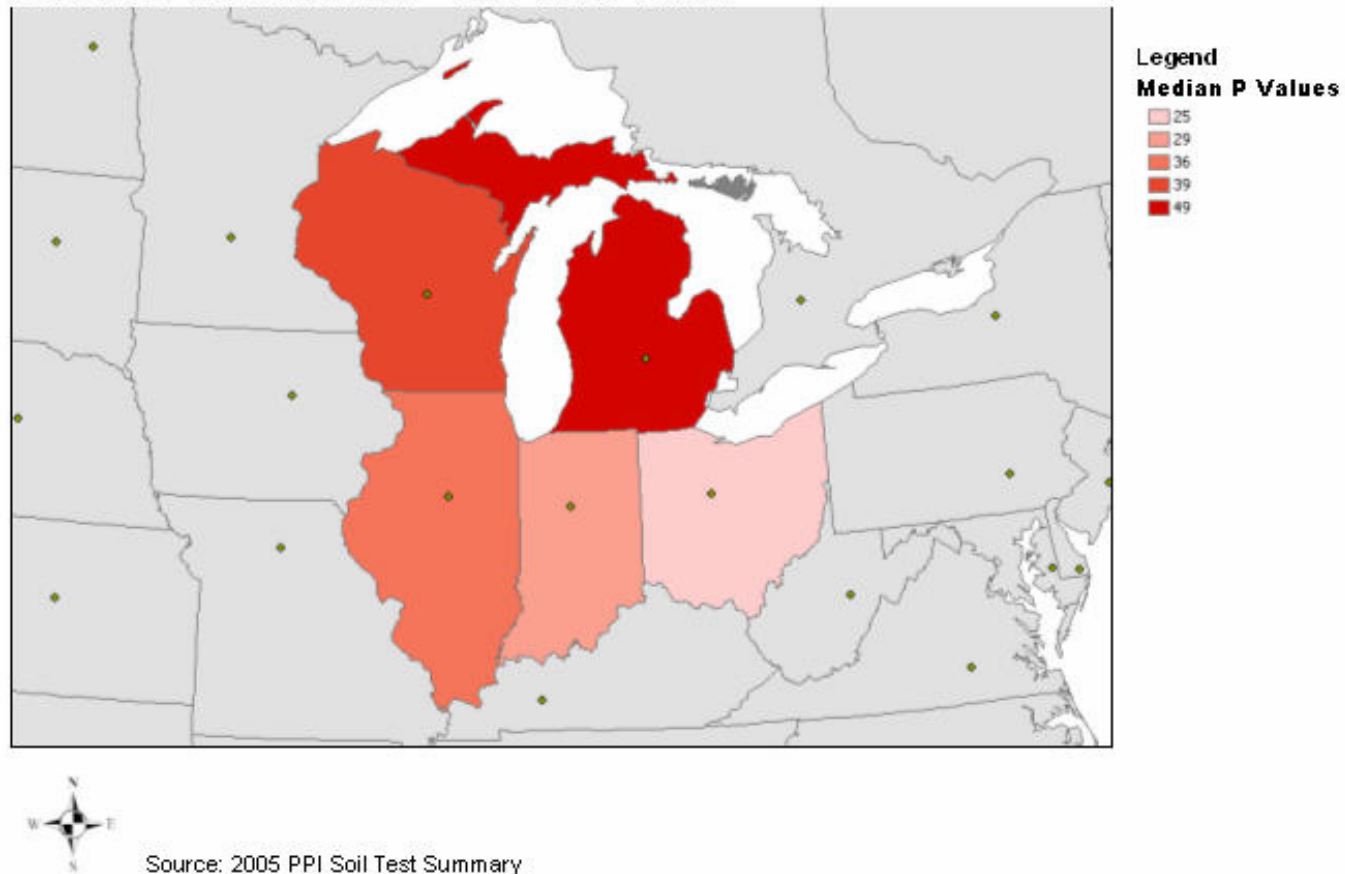
NuGIS

Nutrient Use Geographic Information System

Median P Soil Test Values, Selected States

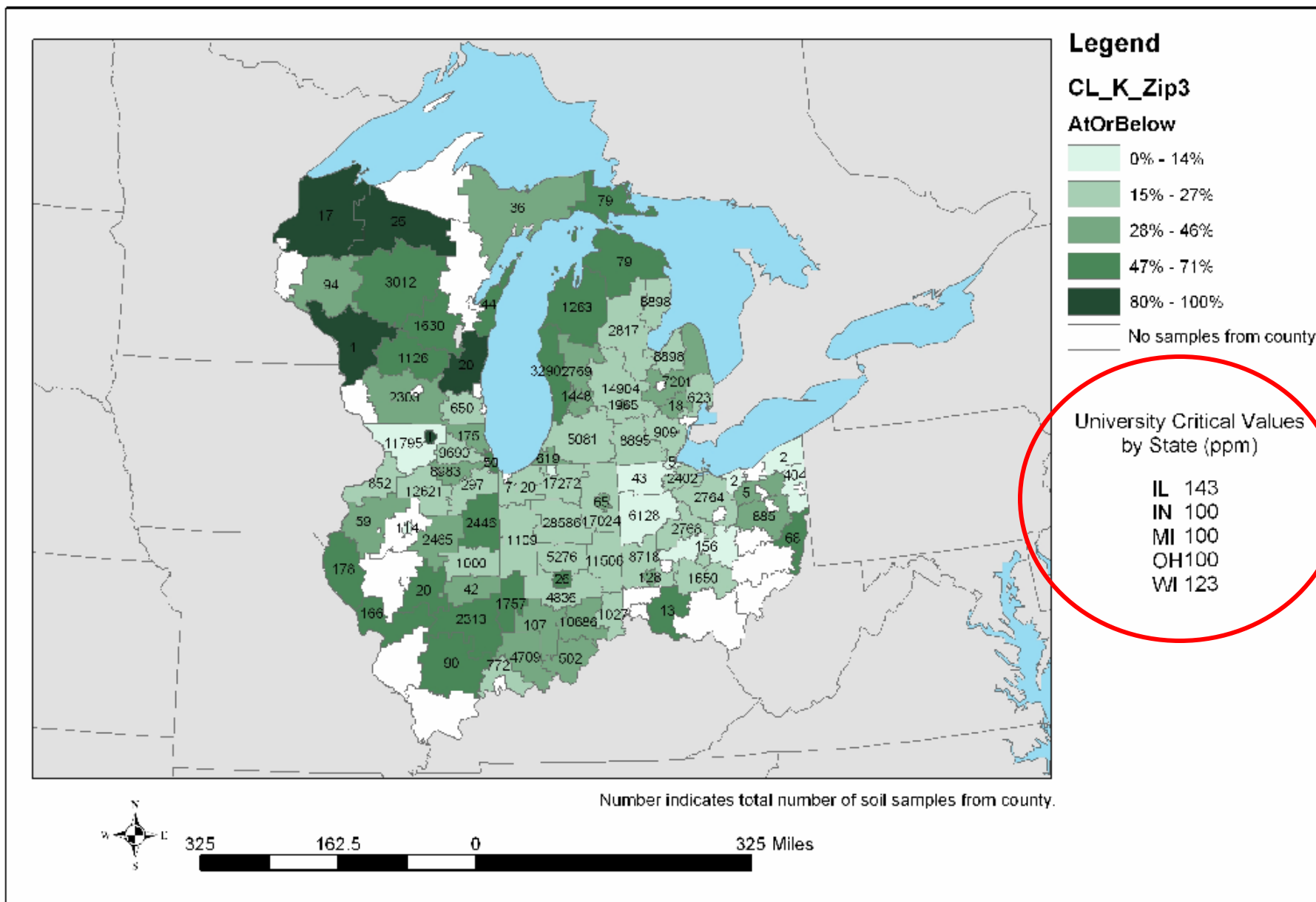
Nutrient Use GIS

2005 Soil Test Summaries – State Level Values



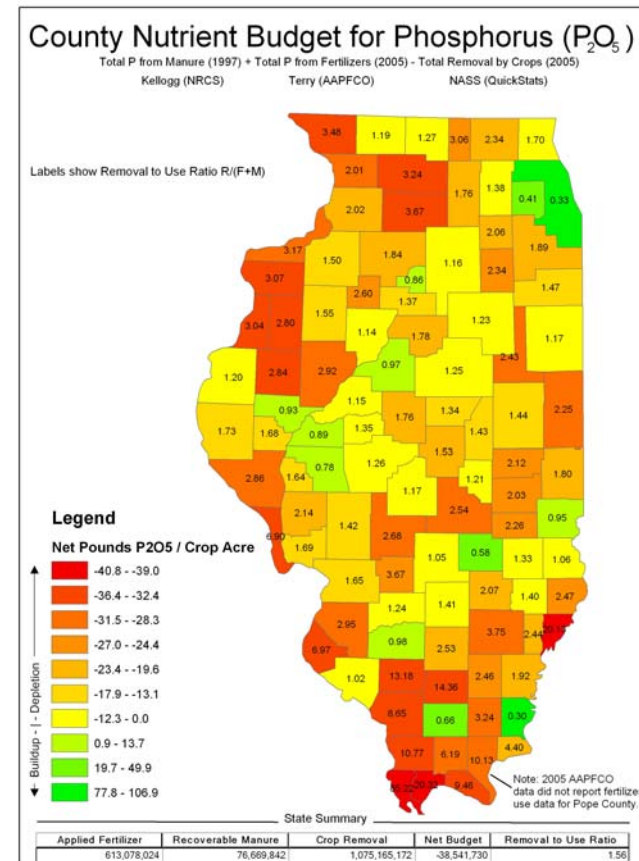
Soil Samples by 3-Digit Zip Code

Percentage of Samples At or Below the University Critical K Value



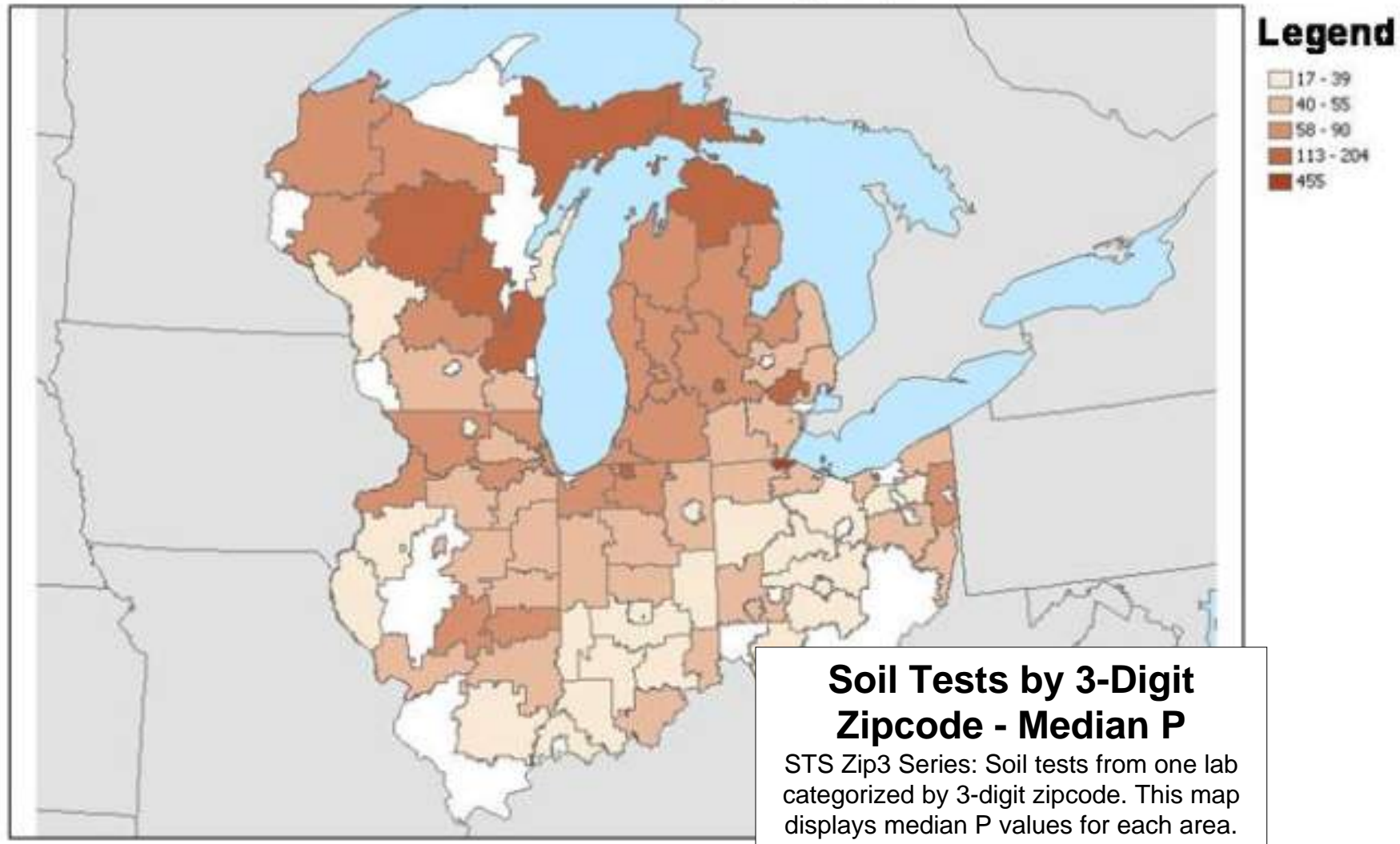
EXAMPLE GIS DATA ANALYSIS FOR ILLINOIS

- County $P_{2}O_{5}$ Budgets
- 3 sources: NRCS, AAPFCO, NASS
- Manure Applied
- Fertilizer sold
- Crop Removal
 - Actual yield of major crops
- Computations on county basis
- Aggregation to watershed basis



Nutrient Use GIS

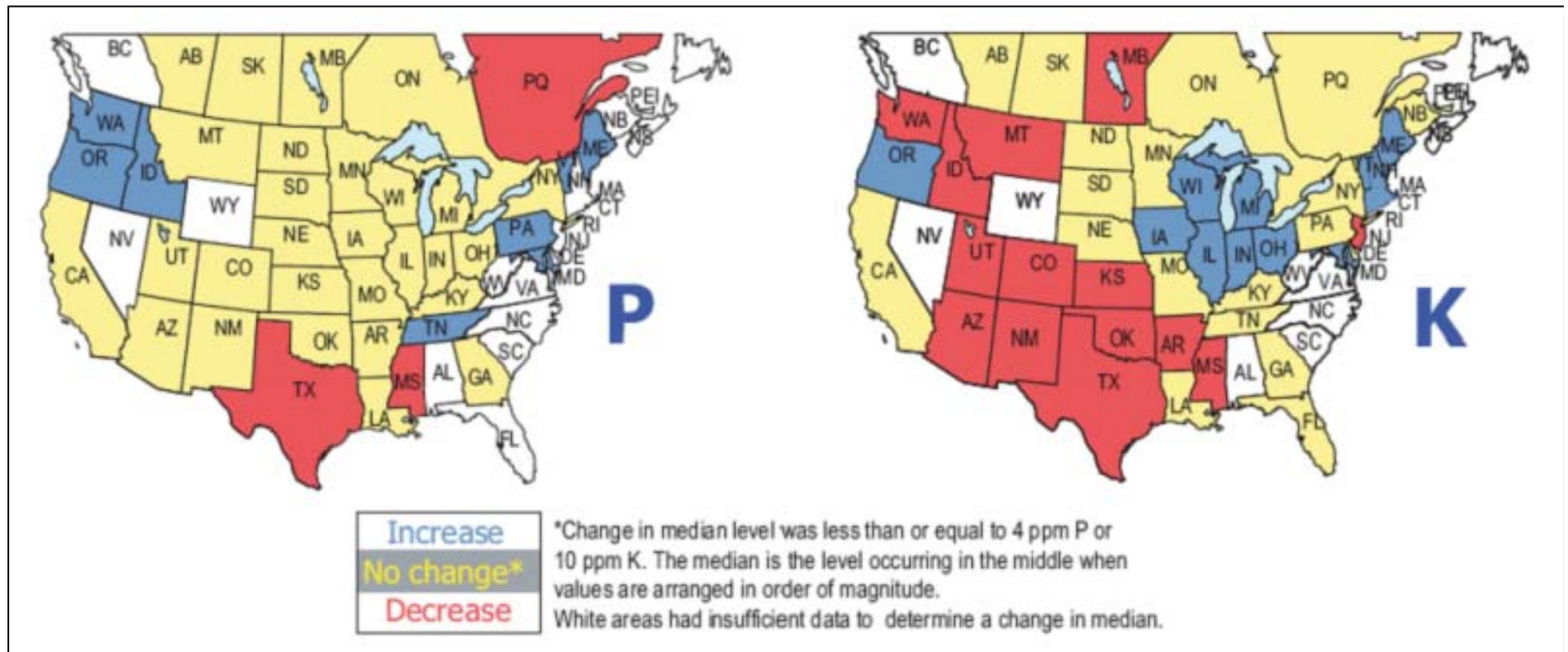
2005 Soil Test Summaries – Median P by 3-digit Zip Code



Source: 2005 PPI Soil Test Summary



CHANGE IN TYPICAL SOIL TEST LEVELS FROM 2001 TO 2005



The Fertility of North American Soils

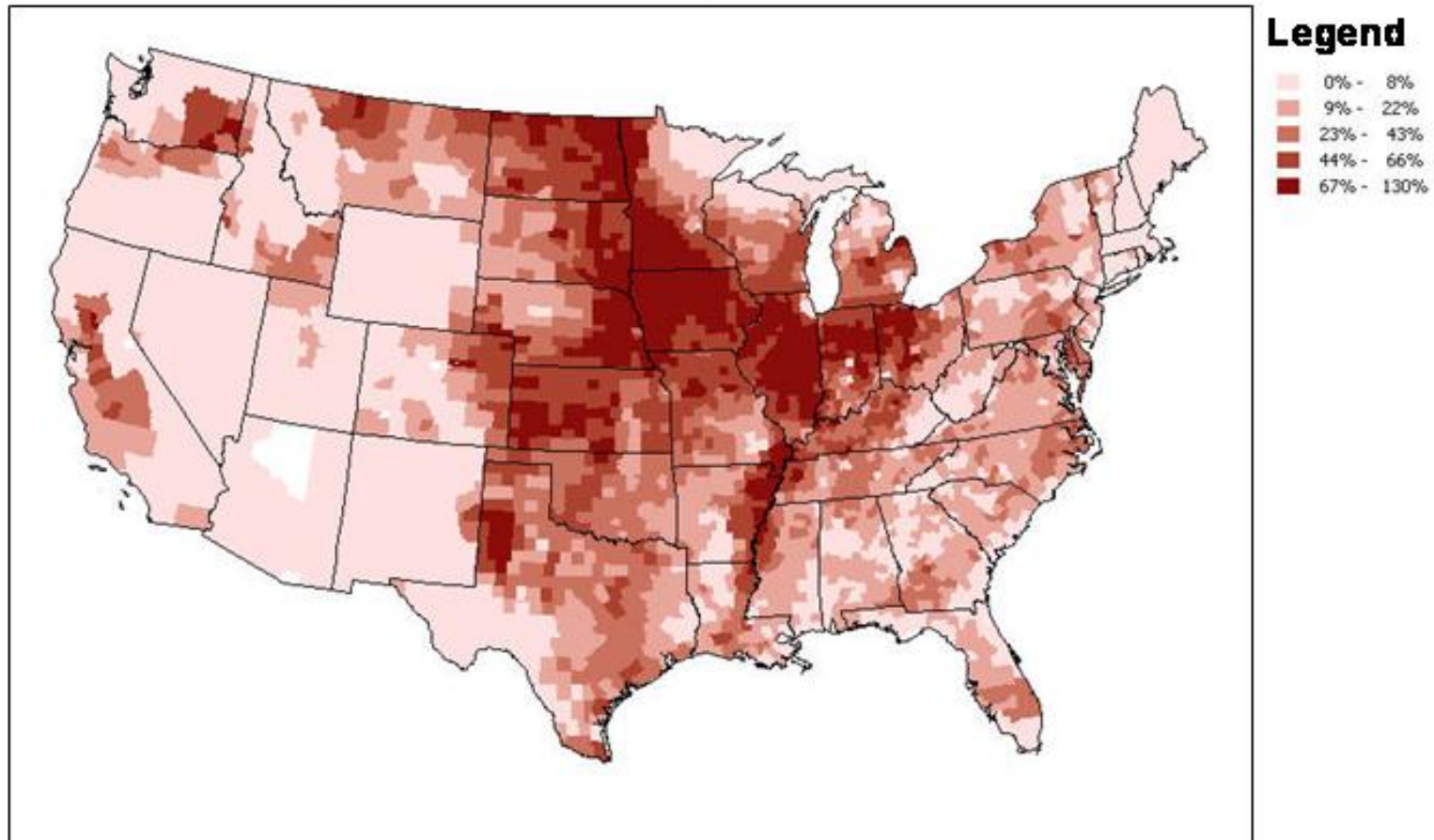
By P.E. Fixen, T.W. Bruulseema, A.M. Johnston,
R.L. Mikkelsen, T.S. Murrell, C.S. Snyder, and W.M. Stewart
Potash & Phosphate Institute (PPI)



2006

Nutrient Use GIS

Acres of Total Cropland as a Percentage of Land Area

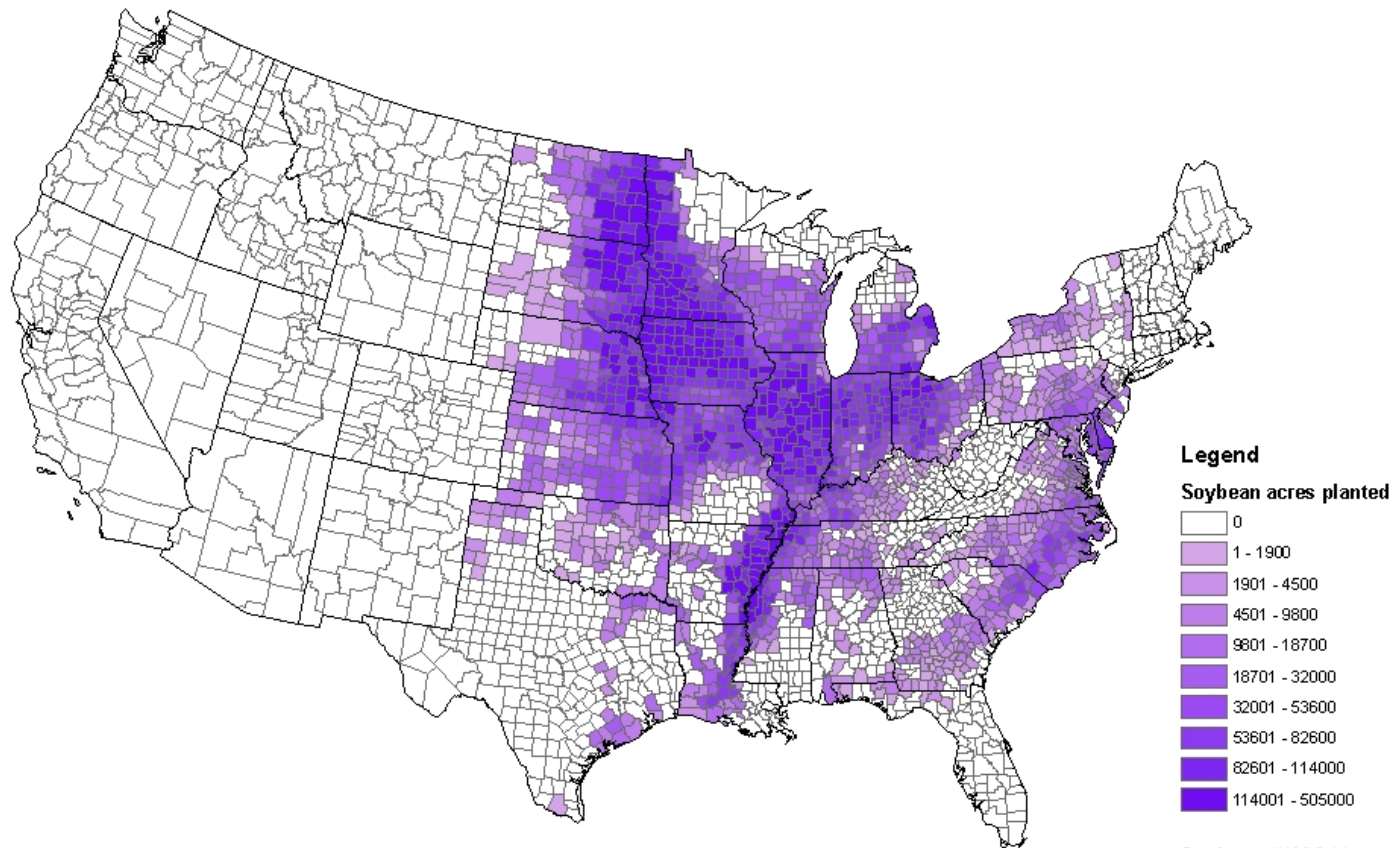


The acres of total cropland as a percentage of land area in acres. A value of zero may represent a zero data value or may mean that no data are available for the county. The percentage values may be greater than 100 because the land area in acres is calculated as the land within the county and the acres of total cropland are calculated for the entire farm, which may include parts of more than one county. (Source: National Atlas of the United States)



Planted Acres

2004 Planted Acres in Soybeans



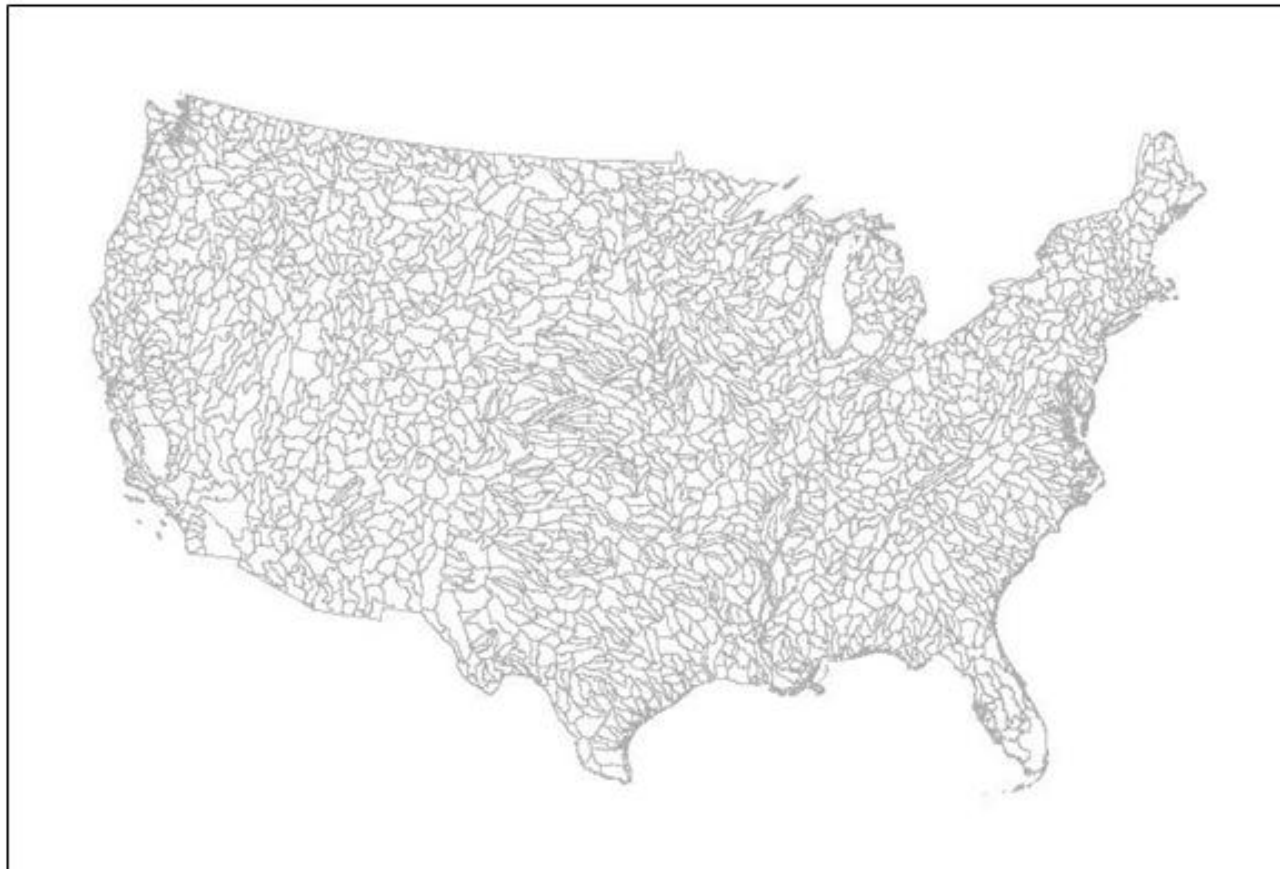
Data Source: NAS S Quickstats



2,100,000 1,050,000 0 2,100,000 Feet

Nutrient Use GIS

8-Digit Hydrologic Units

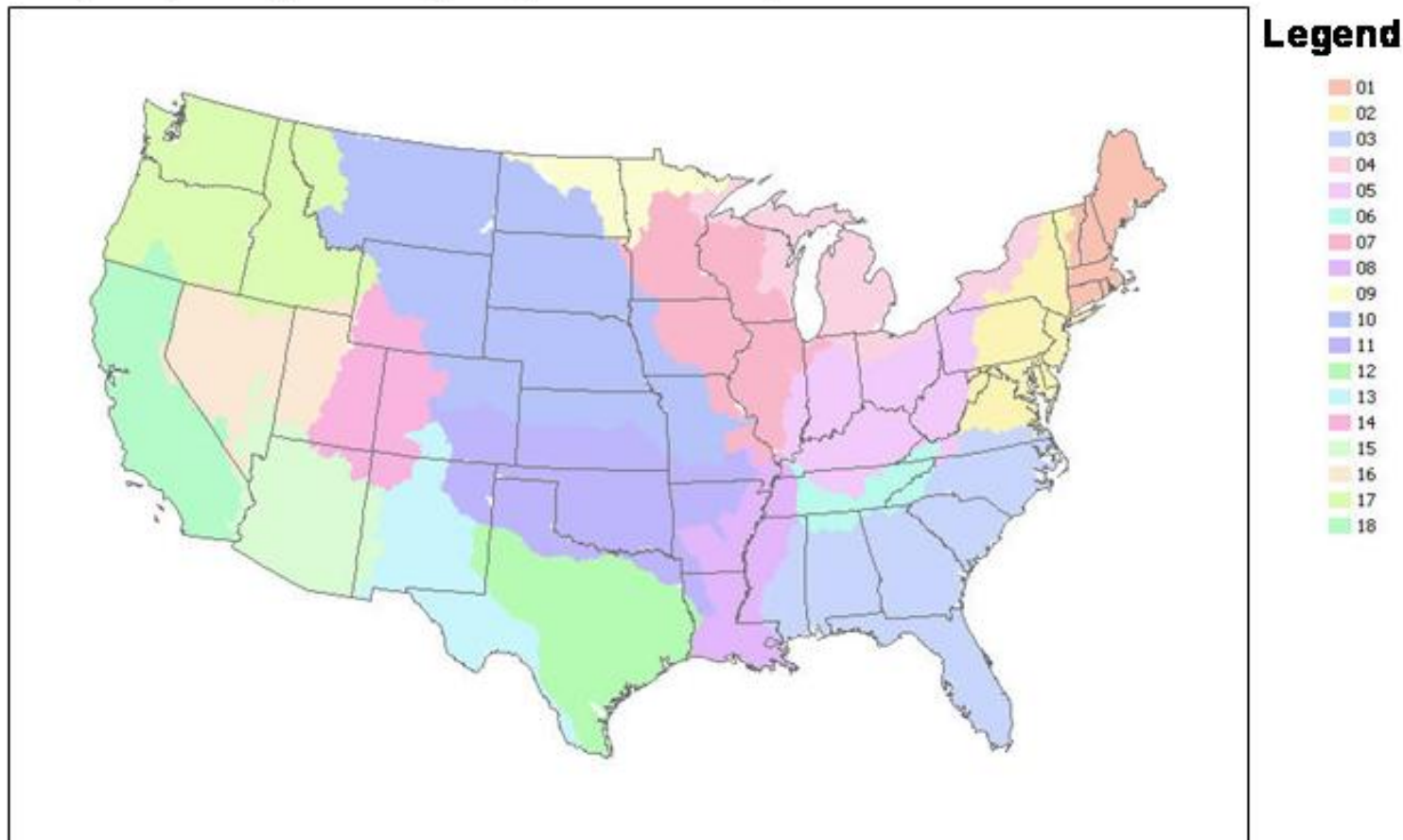


Legend



Nutrient Use GIS

Major Hydrologic Units (2-Digit Watersheds)

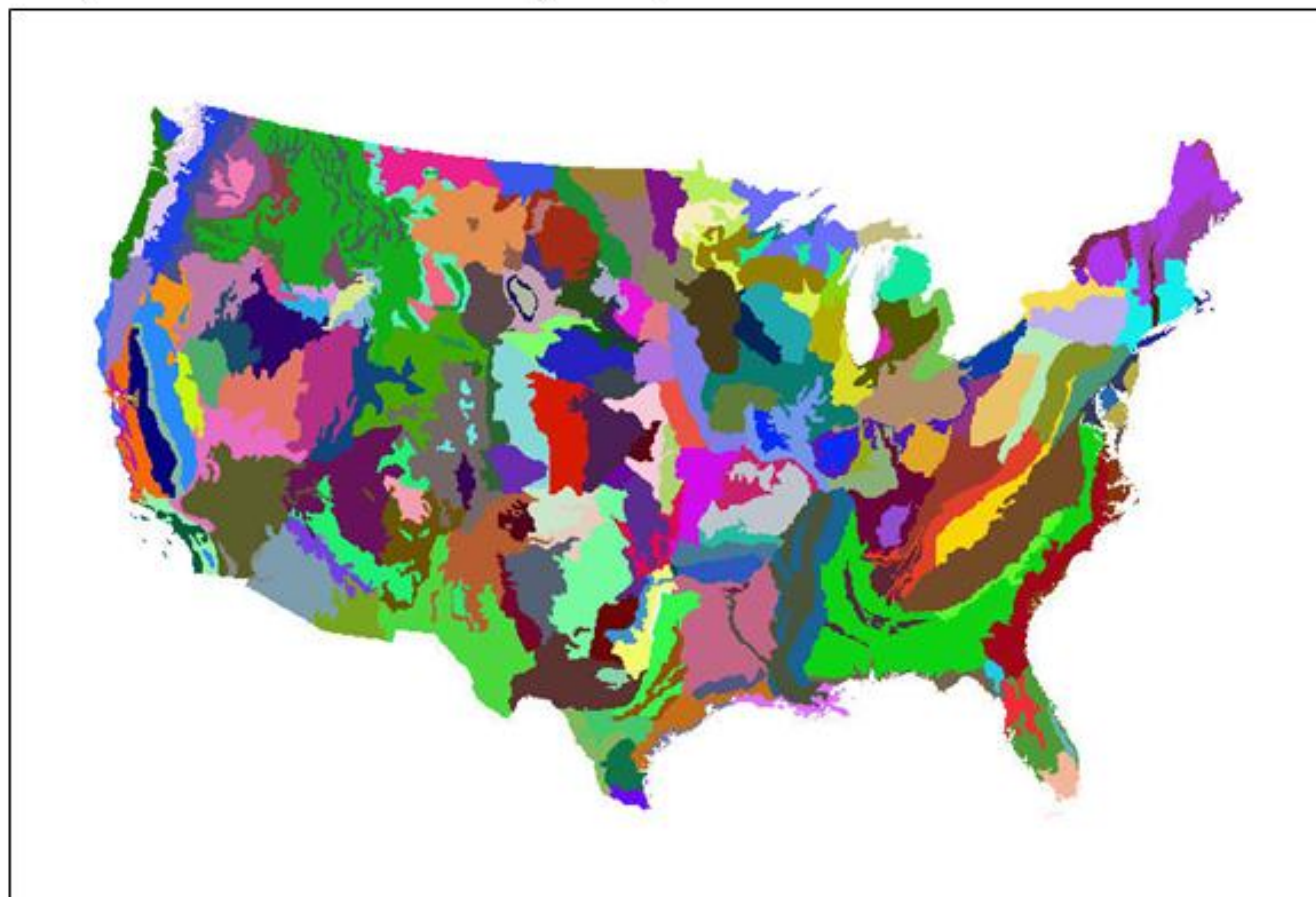


<http://water.usgs.gov/GIS/huc.html>



Nutrient Use GIS

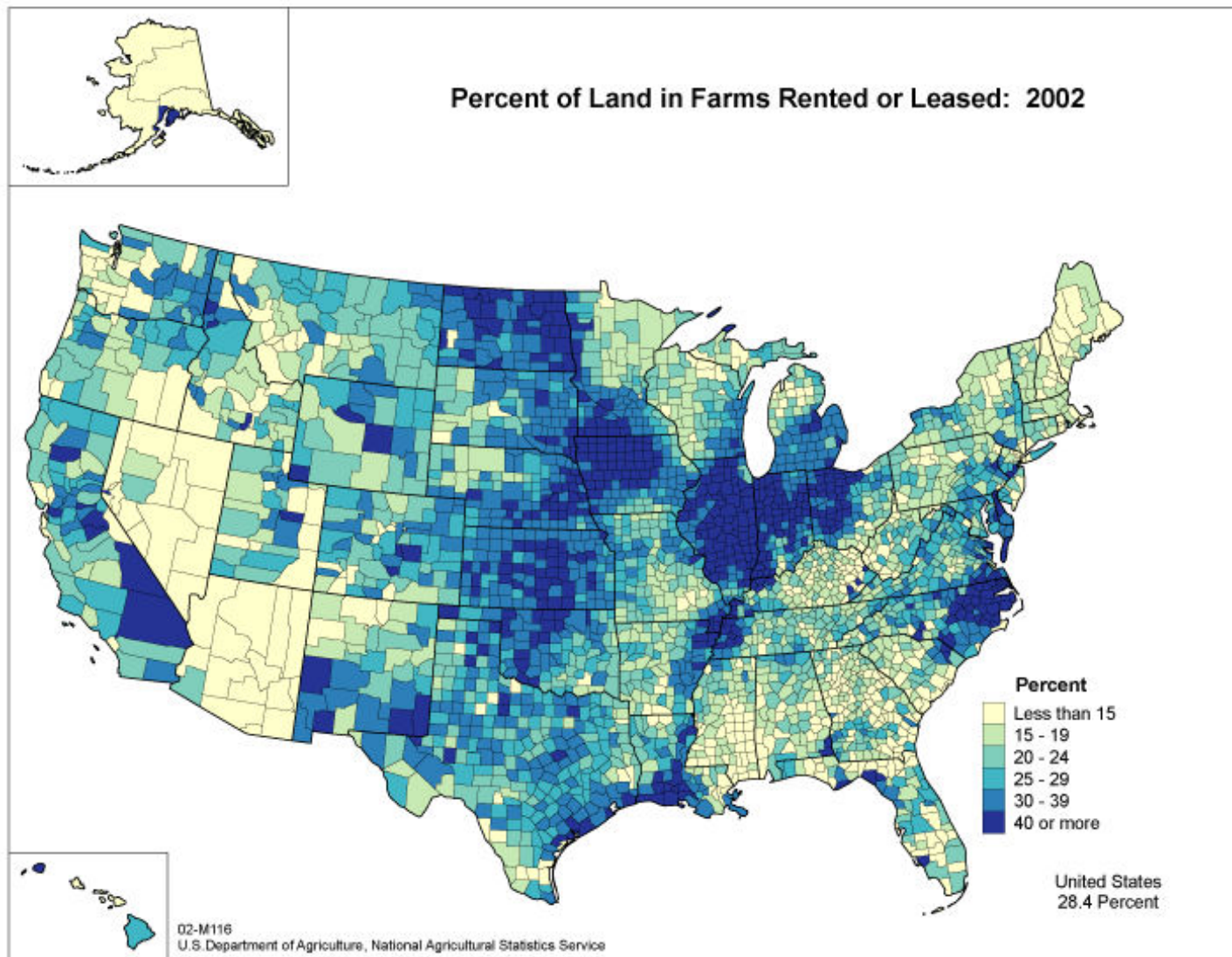
Major Land Resource Area (MLRA)

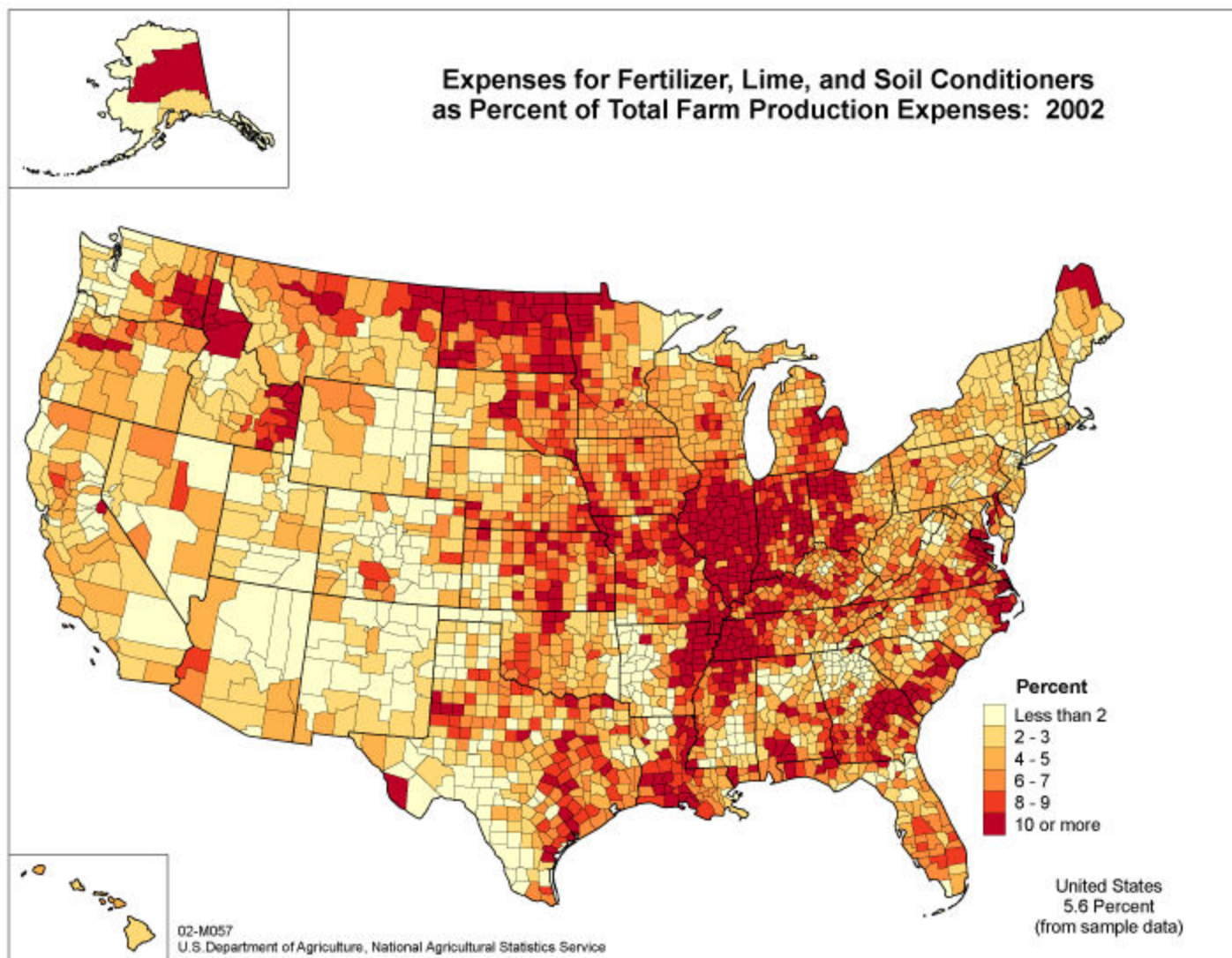


Legend

Major land resource areas (MLRAs) are geographically associated land resource units (LRUs). Identification of these large areas is important in statewide agricultural planning and has value in interstate, regional, and national planning.





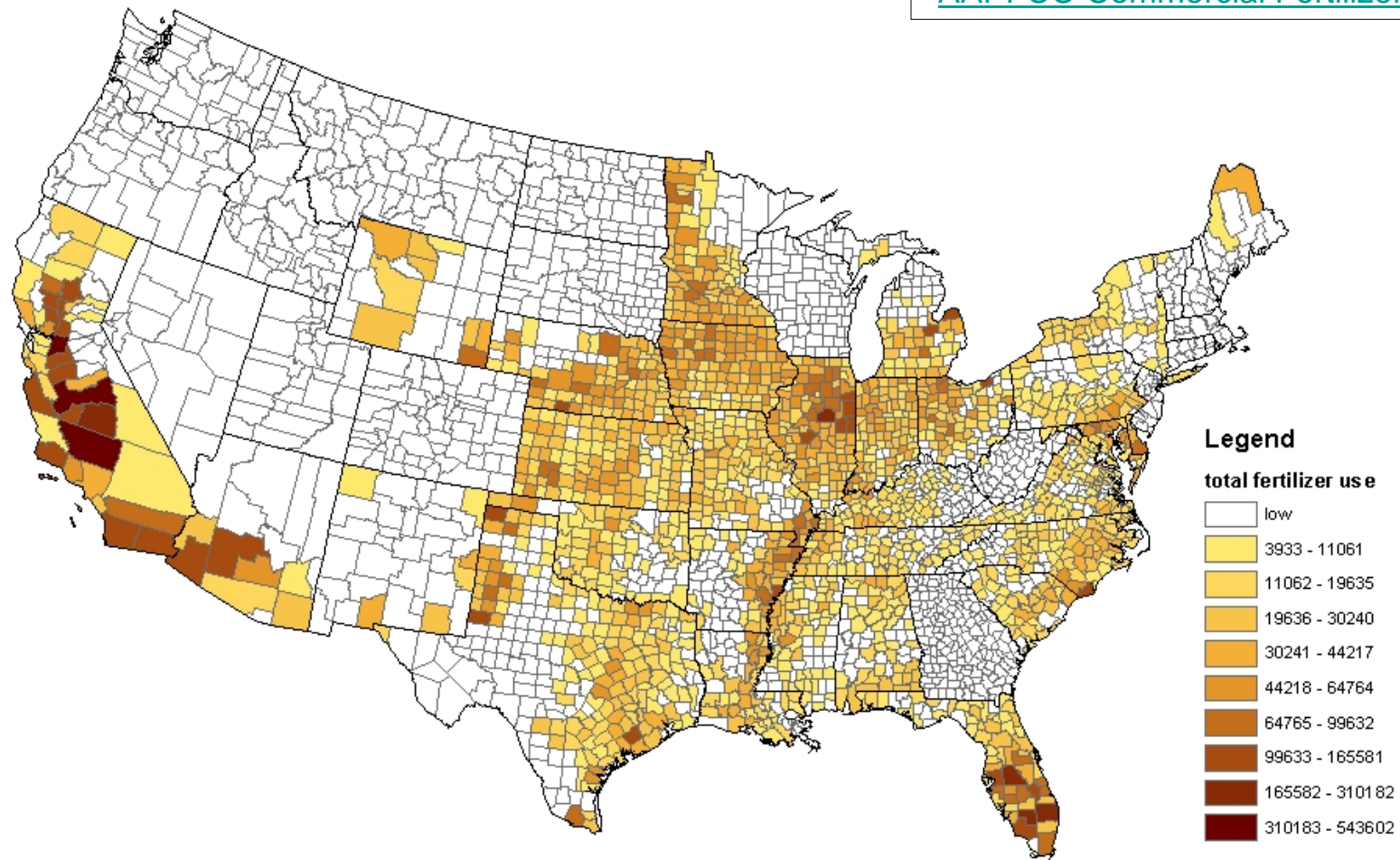


Total Fertilizer Use in 2000

[AAPFCO Commercial Fertilizers, 2000](#)

Nutrient Use

Total Fertilizer Use in 2000



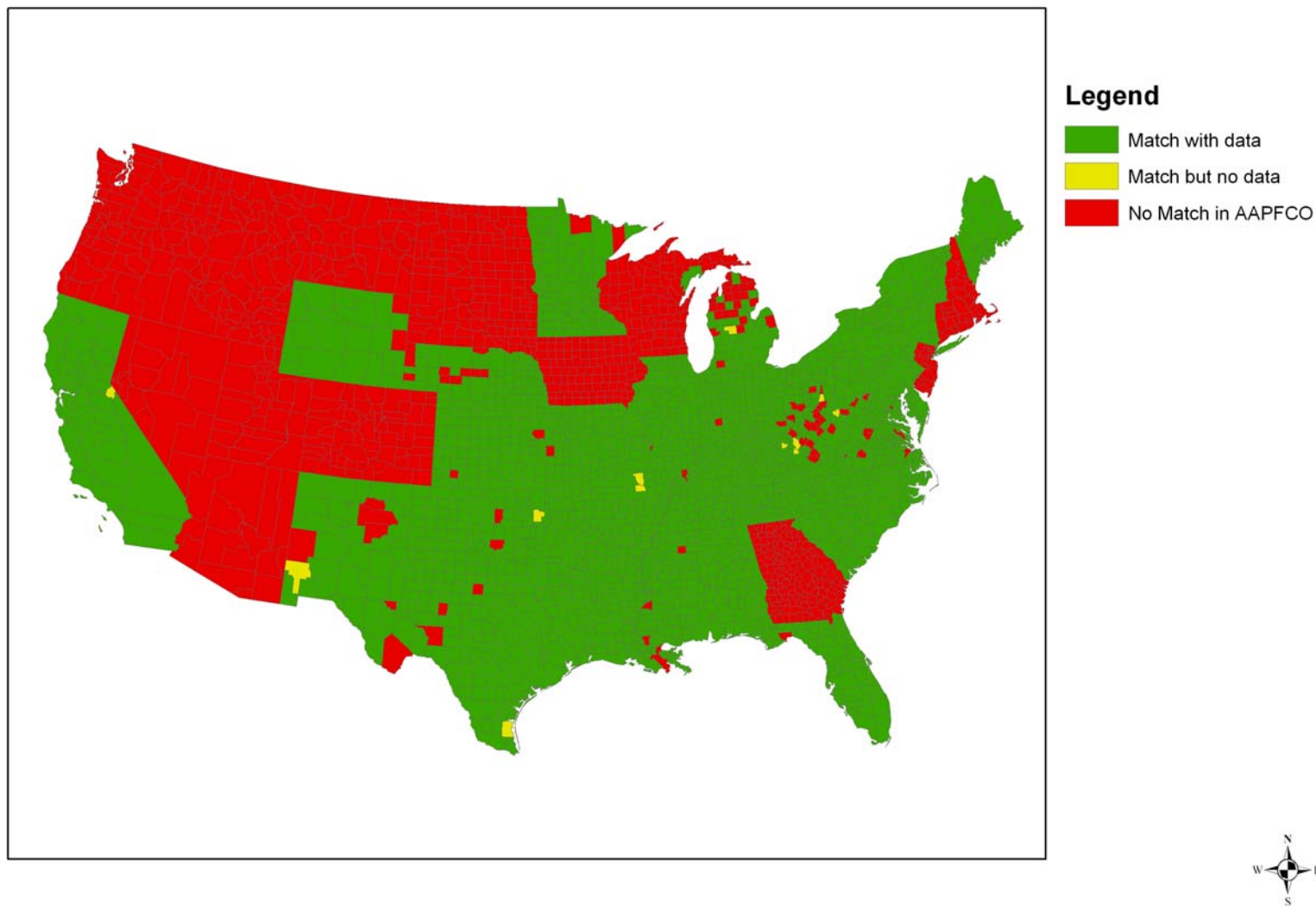
Data Source: AAPFCO
Commercial Fertilizer, 2000



2,100,000 1,050,000 0 2,100,000 Feet

AAPFCO Data Availability 2005

Shows where AAPFCO is available at the county level.

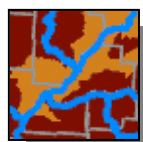




EWG Report



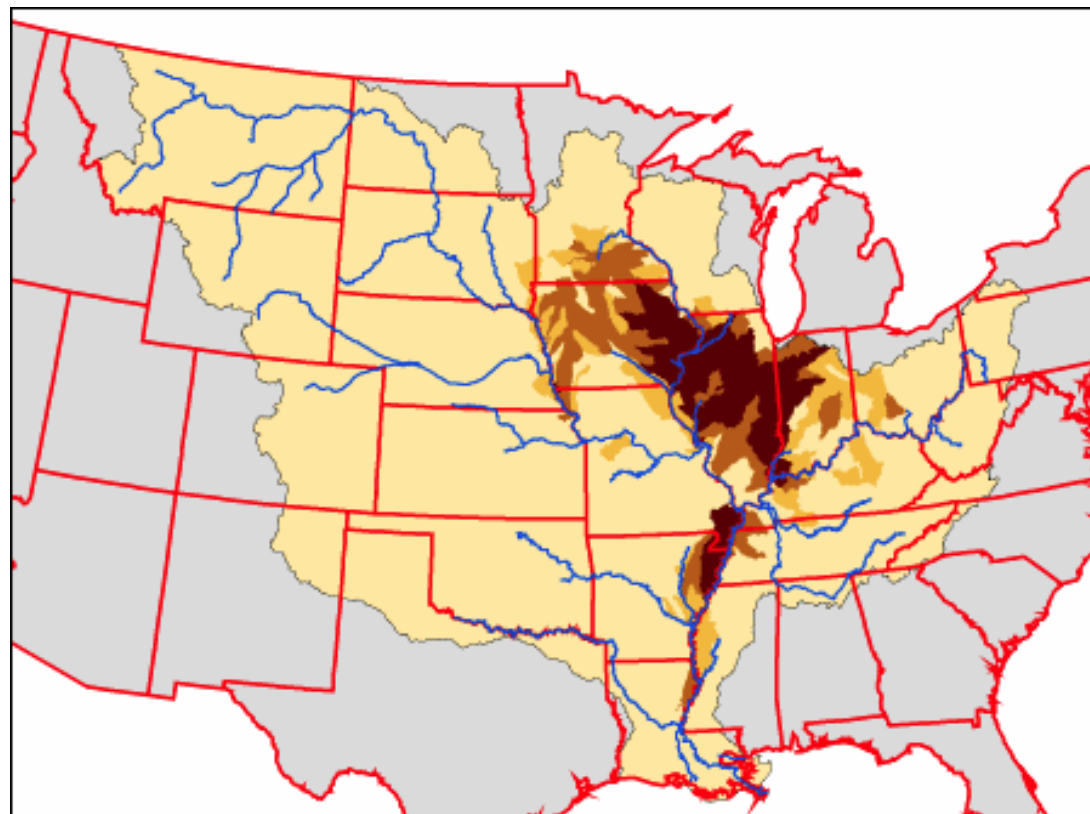
5% of the MRB that
accounts for 40% of
fertilizer N pollution



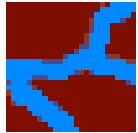
10% of the MRB that
accounts for 65% of
fertilizer N pollution



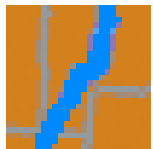
15% of the MRB that
accounts for 80% of
fertilizer N pollution



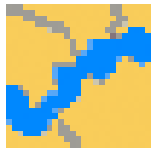
DEAD ZONE POLLUTION FROM ILLINOIS



Top Dead Zone Polluting Watersheds in Illinois

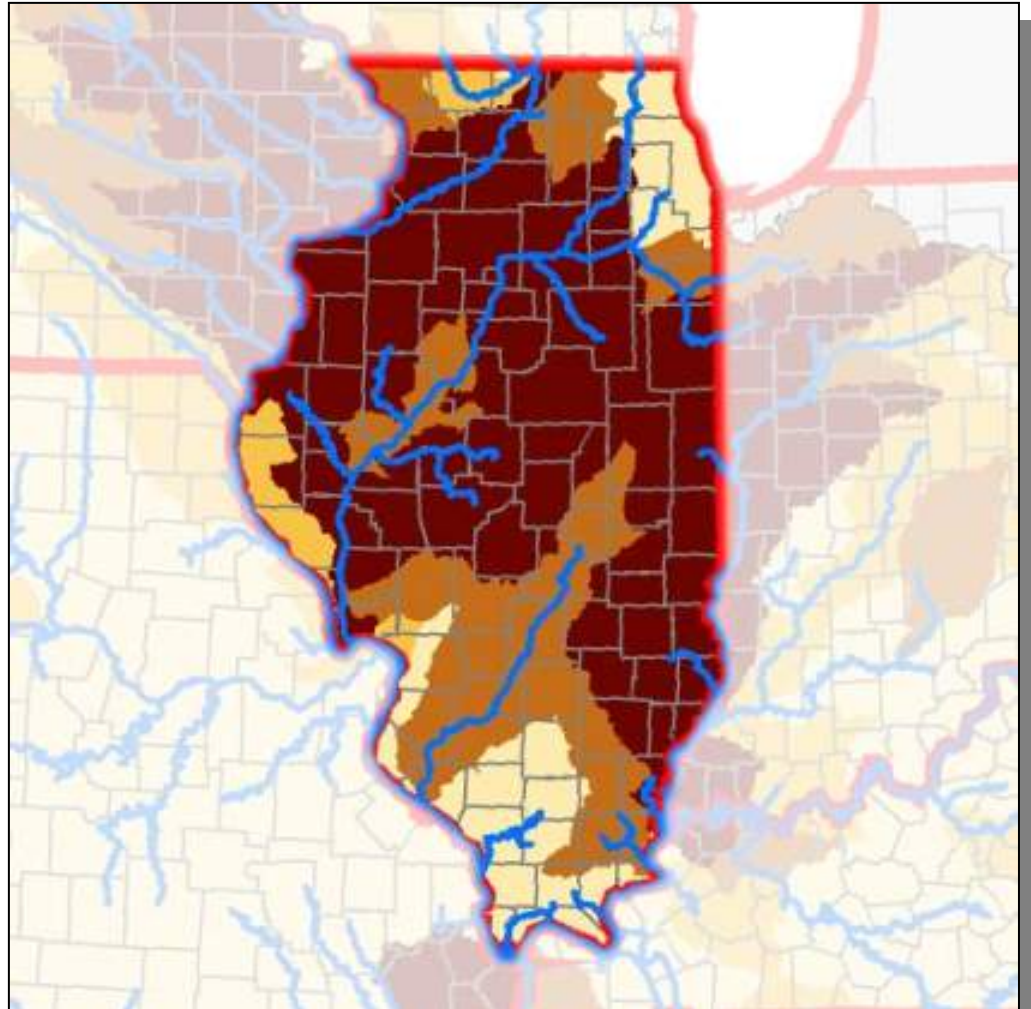


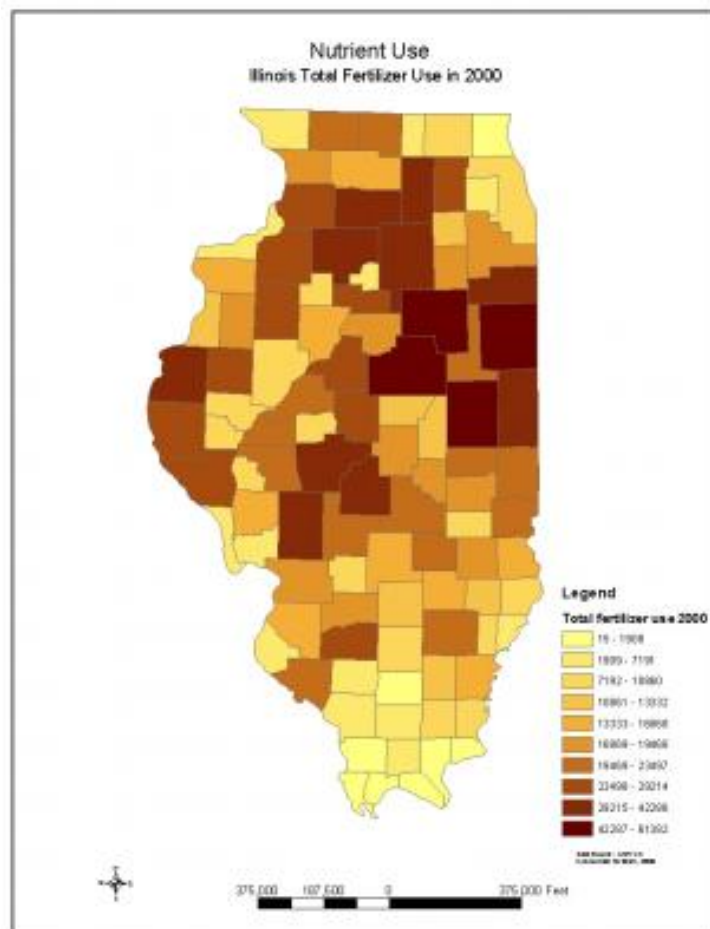
Second Tier Dead Zone Polluting Watersheds in Illinois



Third Tier Dead Zone Polluting Watersheds in Illinois

***Are databases available
accurate and current??***





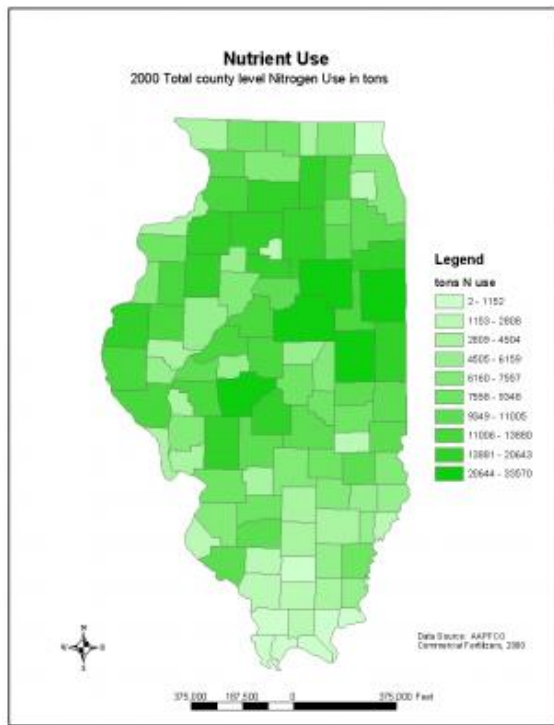
Illinois Total Fertilizer Use for 2000

[AAPFCO Commercial Fertilizers, 2000](#)

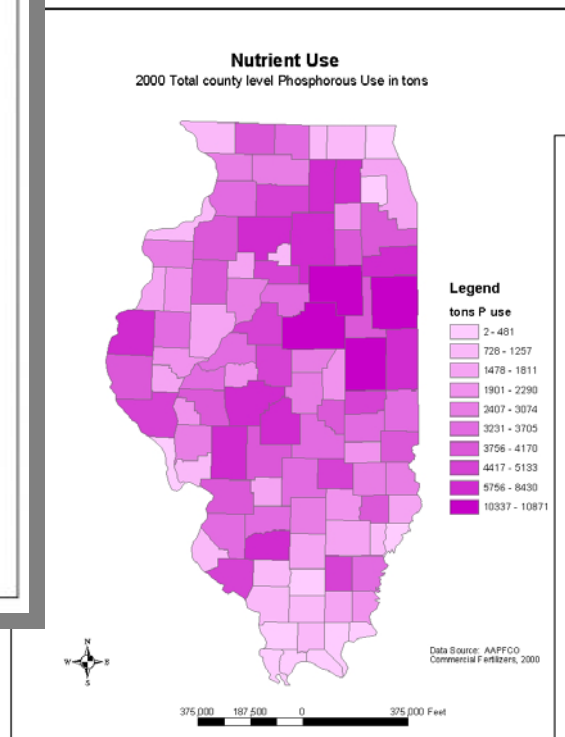
Illinois county level fertilizer use for 2000

AAPFCO Commercial
Fertilizers, 2000

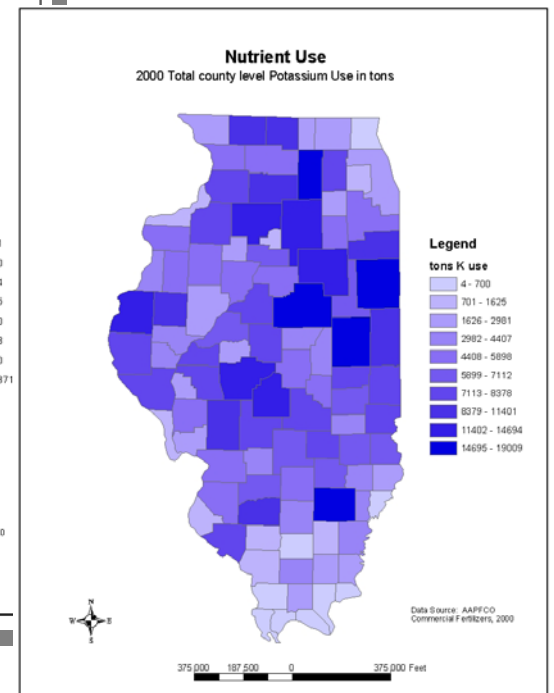
N



P



K



County Nutrient Budget for Phosphorus (P_2O_5)

Total P from Manure (1997) + Total P from Fertilizers (2005) - Total Removal by Crops (2005)

Kellogg (NRCS)

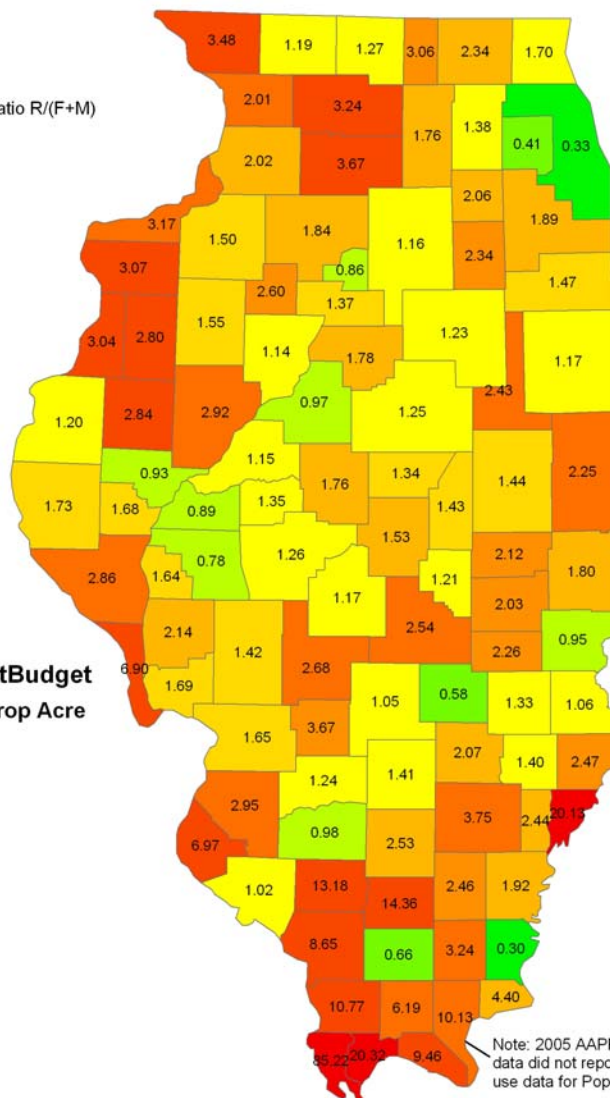
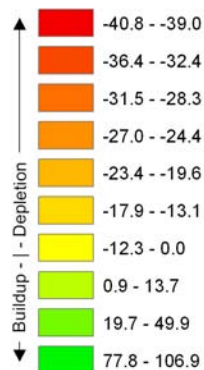
Terry (AAPFCO)

NASS (QuickStats)

Labels show Removal to Use Ratio R/(F+M)

Legend

IL_County_NutrientBudget
Net Pounds P_2O_5 / Crop Acre



Note: 2005 AAPFCO data did not report fertilizer use data for Pope County.

State Summary

Applied Fertilizer	Recoverable Manure	Crop Removal	Net Budget	Removal to Use Ratio
613,078,024	76,669,842	1,075,165,172	-385,417,307	1.56

WCI Nutrient Budget for Phosphorus (P₂O₅)

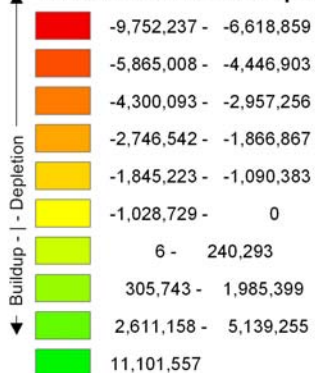
Total P from Manure (1997) + Total P from Fertilizers (2005) - Total Removal by Crops (2005)
 Kellogg (NRCS) Terry (AAPFCO) NASS (QuickStats)

The Watershed / County Intersect (WCI) map is created by intersecting the 8-digit hydrologic unit map with the county boundaries.

For each new polygon created, a P nutrient budget was calculated.

Legend

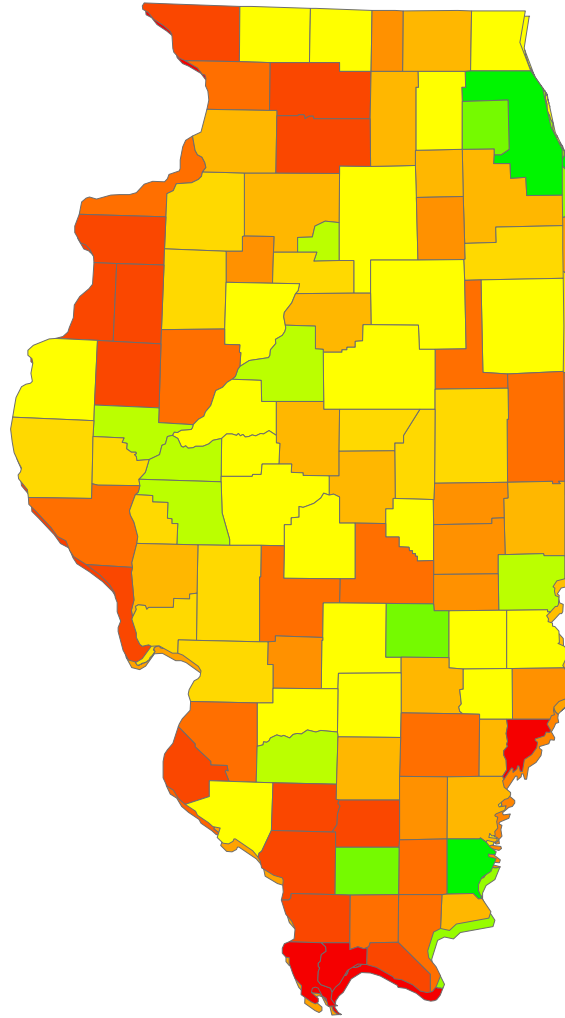
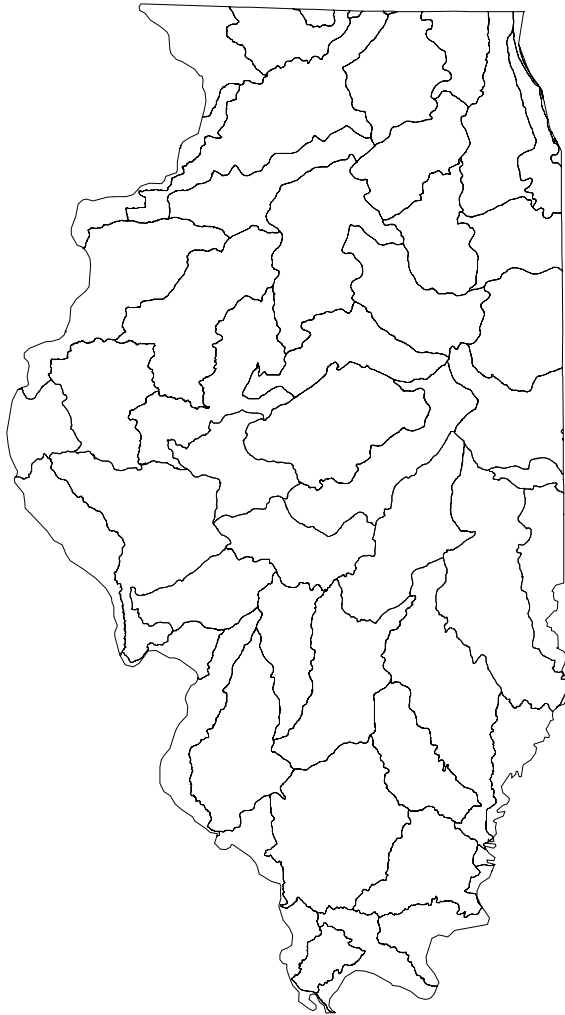
↑ Total Net Pounds P₂O₅ per WCI



Note: 2005 AAPFCO data did not report fertilizer use data for Pope County.

State Summary

Applied Fertilizer	Recoverable Manure	Crop Removal	Net Budget	Removal to Use Ratio
613,078,024	76,669,842	1,075,165,172	-385,417,307	1.56



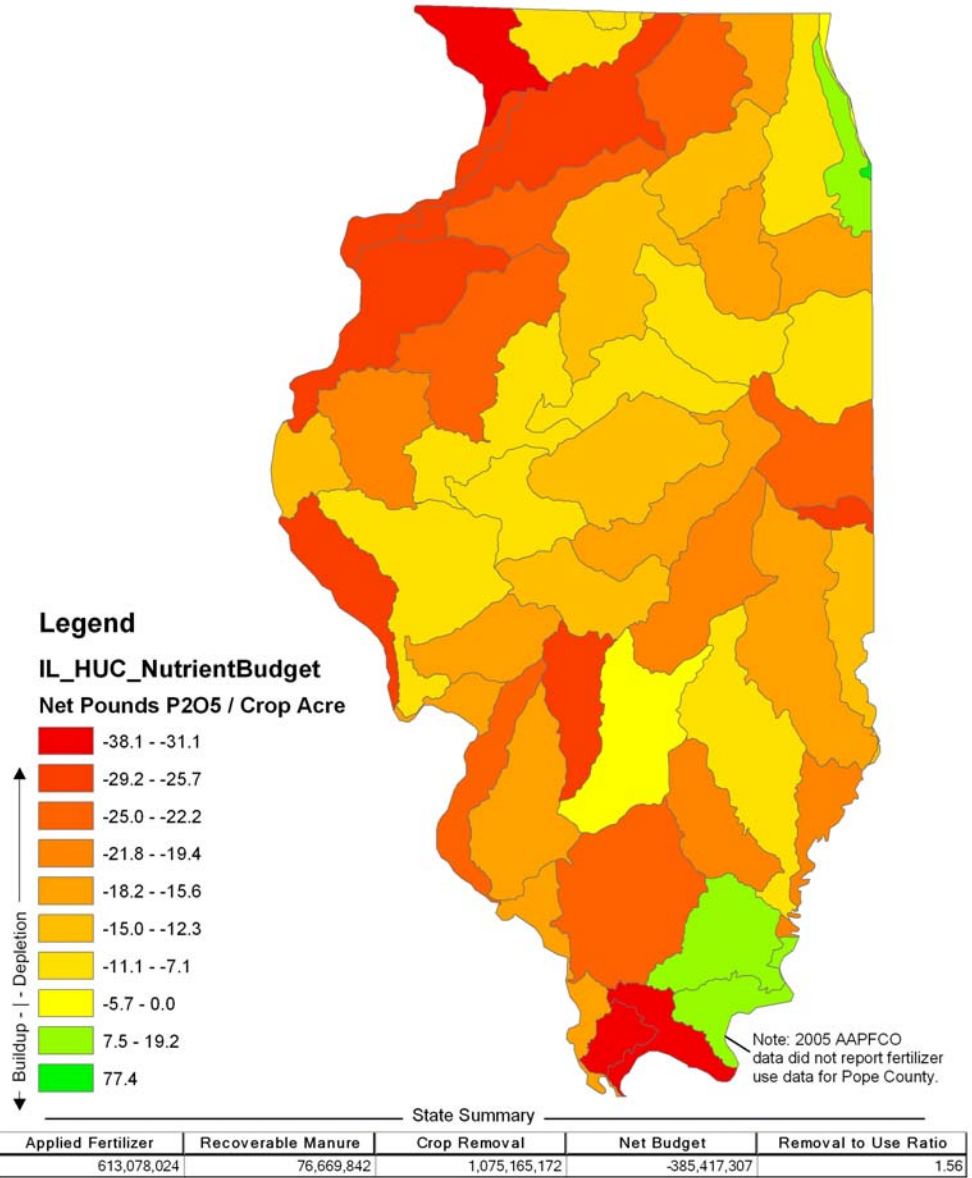
Watershed Nutrient Budget for Phosphorus (P_2O_5)

Total P from Manure (1997) + Total P from Fertilizers (2005) - Total Removal by Crops (2005)

Kellogg (NRCS)

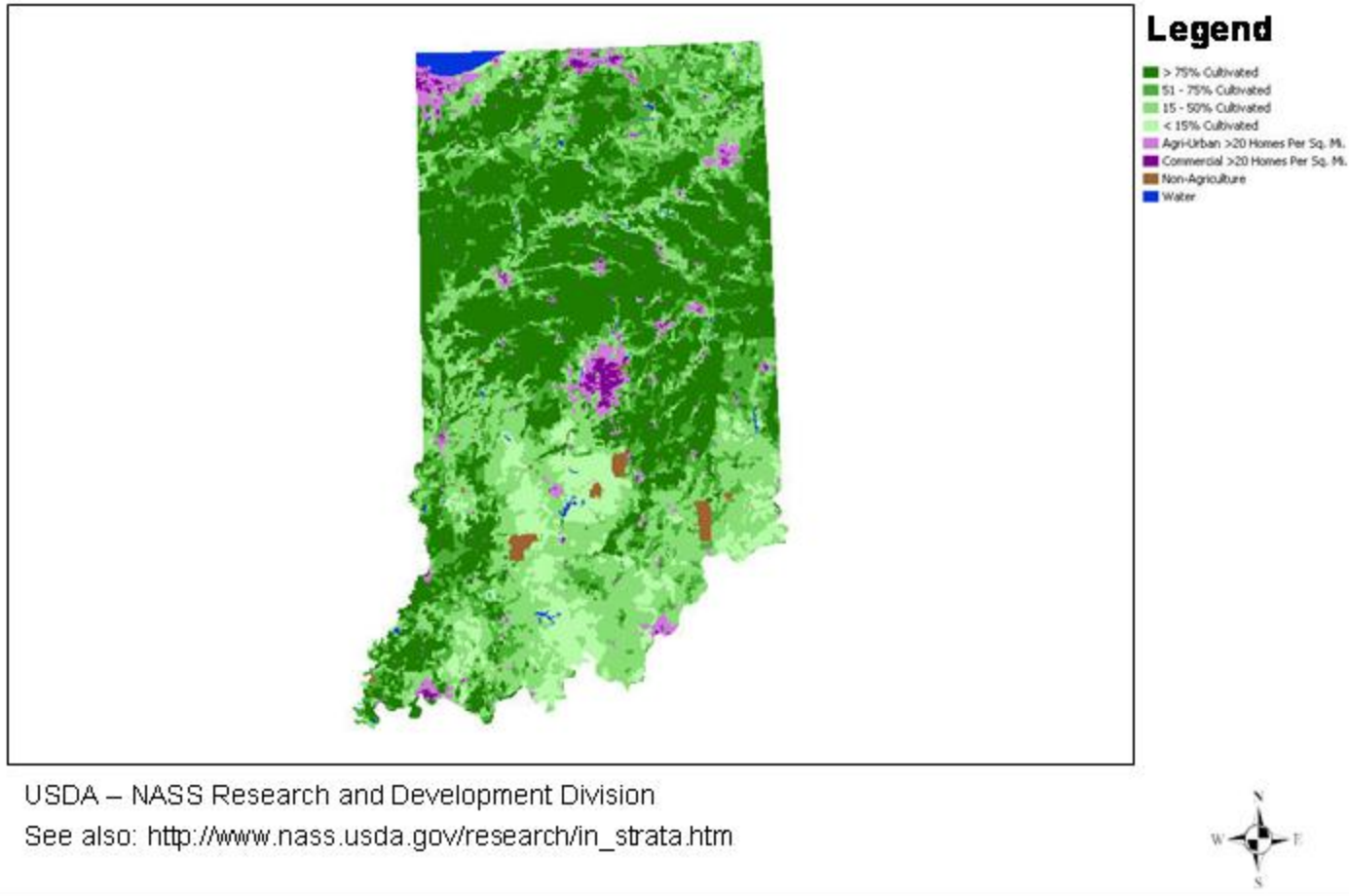
Terry (AAPFCO)

NASS (QuickStats)



GIS FERTILIZER DATA MAY BE COMBINED WITH OTHER GEOSPATIAL DATA FOR ANALYSIS & INTERPRETATION

Nutrient Use GIS Indiana Land Use Strata 2004



WATERSHED P₂O₅ NUTRIENT BUDGET

Data Sources

- NASS — crop data (acres planted, acres harvested, yield, production)
- IPNI --- Crop removal rates
- NRCS --- recoverable manure
- AAPFCO --- county fertilizer sales
- **Calculations (by County)**
 - Total crop acres
 - Acres by crop
 - % acres by crop
 - Ratio of cropland acres to total acres

Spatial Analysis

- Tabulate data and import into ArcGIS
- Join the data to the map
- Intersect with watershed map
- **Aggregating Data to Watershed Level**
 - Summing watershed county intersect (WCI) for fertilizer, manure, and removal
 - Fertilizer + Manure - Removal

DATA MANAGEMENT

- GIS provides geospatial coordinates for all data.
 - Additional “information” about data collected
 - Opportunity to interface with other geospatial data sets
 - Opportunity to map information
 - Visual interpretation
 - “Mapematic” operations for analysis
- Ability to associate fertilizer use data with cropping patterns and practices
- Ability to associate fertilizer use with physical features
 - Environmentally sensitive areas—lakes and streams
 - Conservation structures and practices

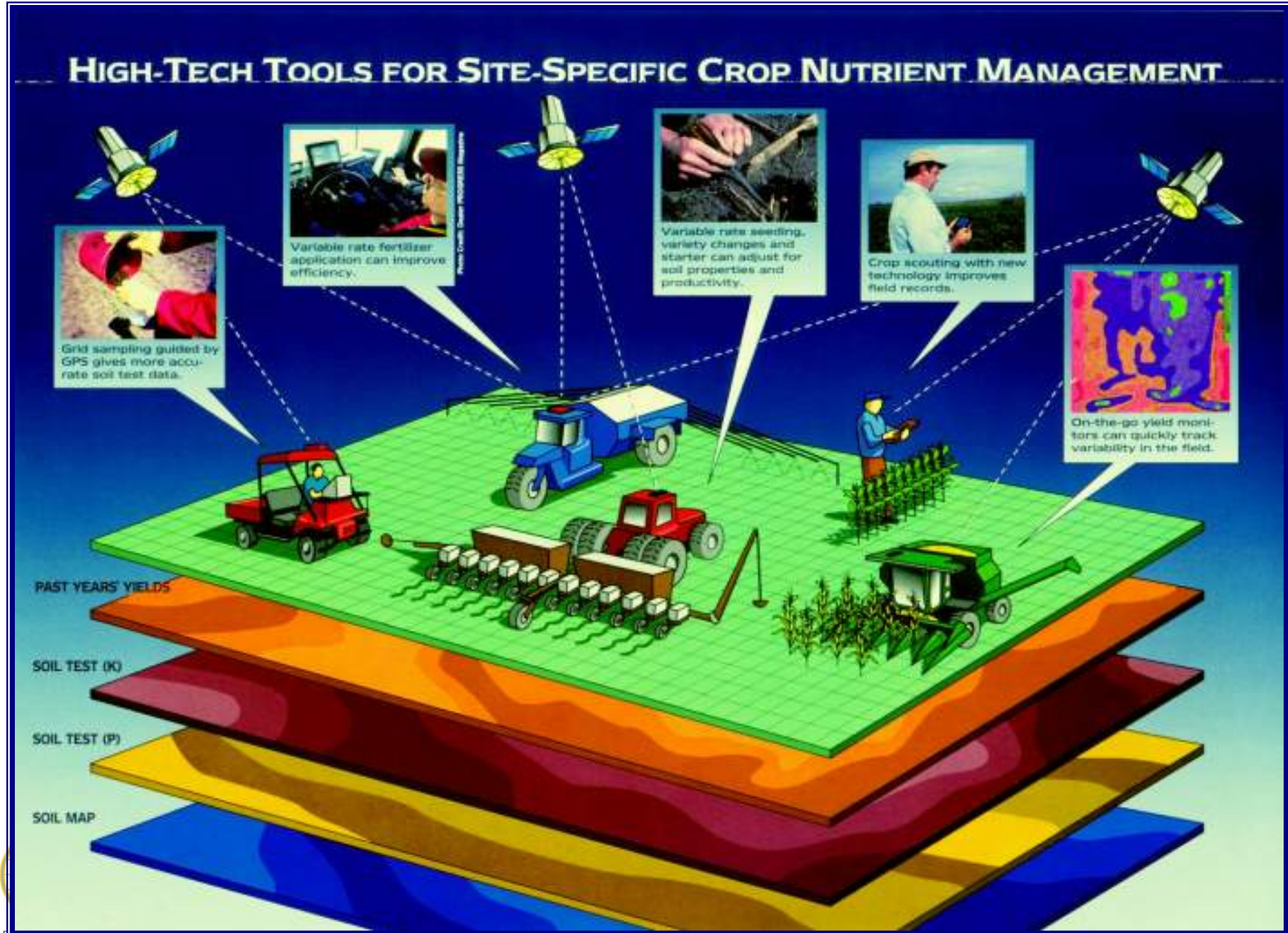
NEEDS ASSESSMENT

- Consistent system for tracking fertilizer sales
 - *Documentation of location where applied would be preferred*
- Need funding to continue support of NASS, ARMS, etc.
 - *More intensive data*
 - *More frequent data*
- New technology
 - *Remote sensing imagery*
 - *GIS data management*
 - *Enhanced models*

FUTURE??? FARM-LEVEL DATA

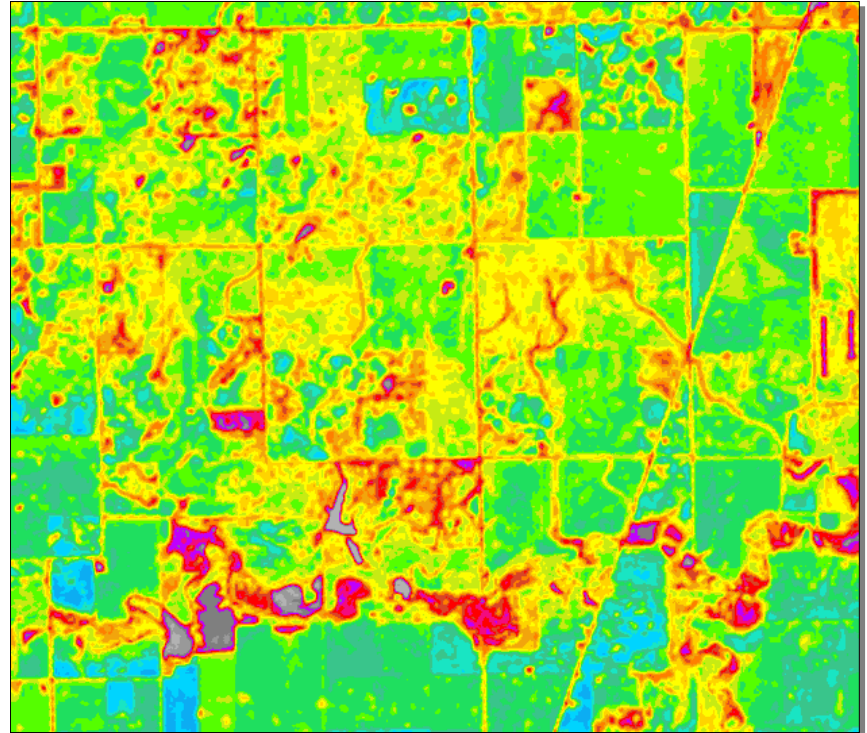
- Site-specific management of nutrients
- Farm/field level GIS
- Dealer/consultant customer data base
- On-farm research
- Aggregate to watershed level
- Voluntary compliance vs regulation issues
- Privacy issues for aggregation

SITE-SPECIFIC MANAGEMENT SYSTEMS

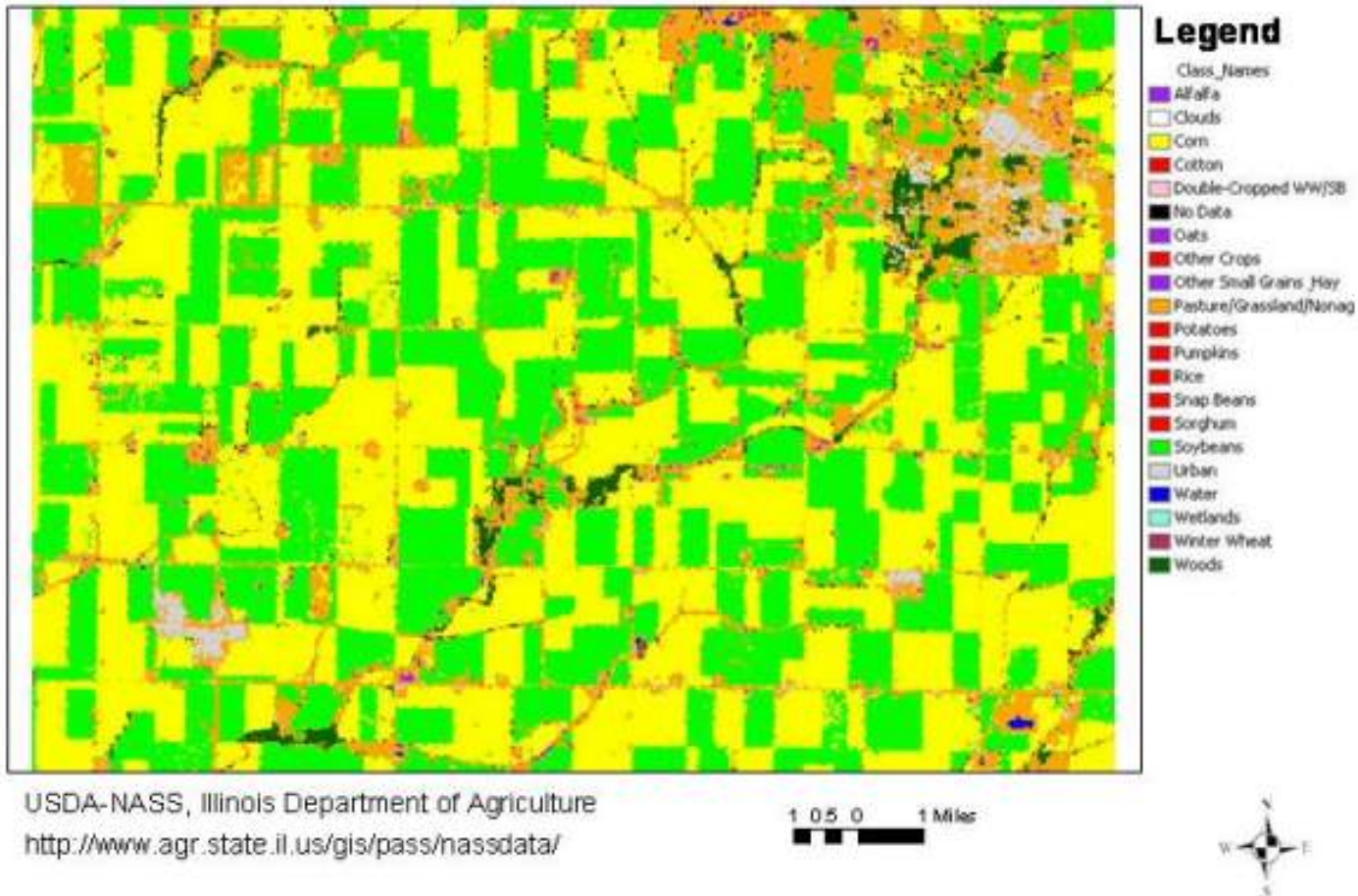


GOALS OF SITE-SPECIFIC MANAGEMENT

- Identify the variability within fields
- Learn the basis of the variability
- Learn to manage the variability



Nutrient Use GIS Illinois Cropland Data Layer (close-up)



Illinois Cropland Data Layer 2005

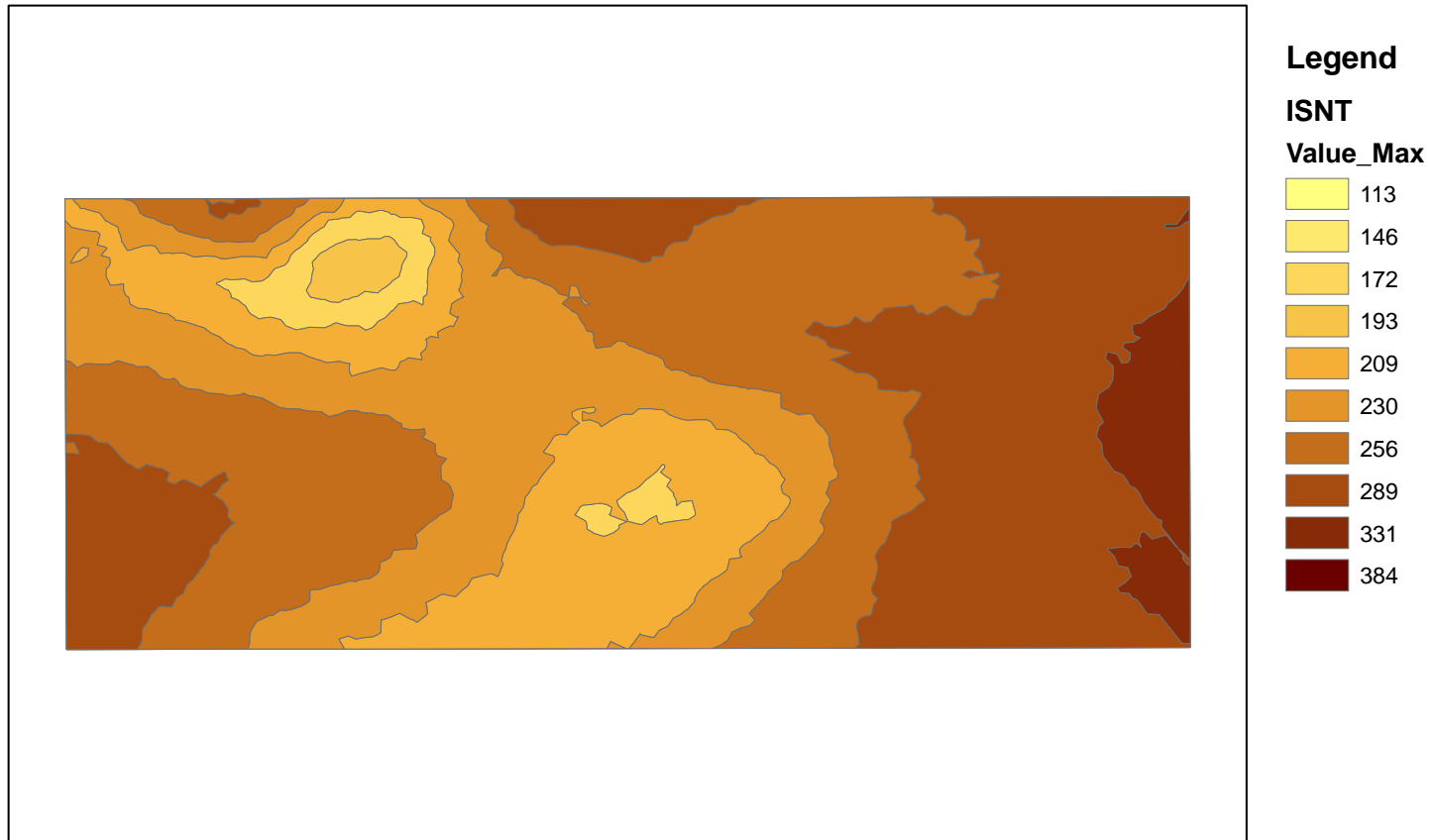
The Cropland Data Layer (CDL) contains crop specific digital data layers, suitable for use in geographic information systems (GIS) applications. This Program annually produces CDLs of the following States: Arkansas, Illinois, Indiana, Iowa, Mississippi,

<http://www.agr.state.il.us/gis/pass/nassdata/>

Illinois Soil N Test

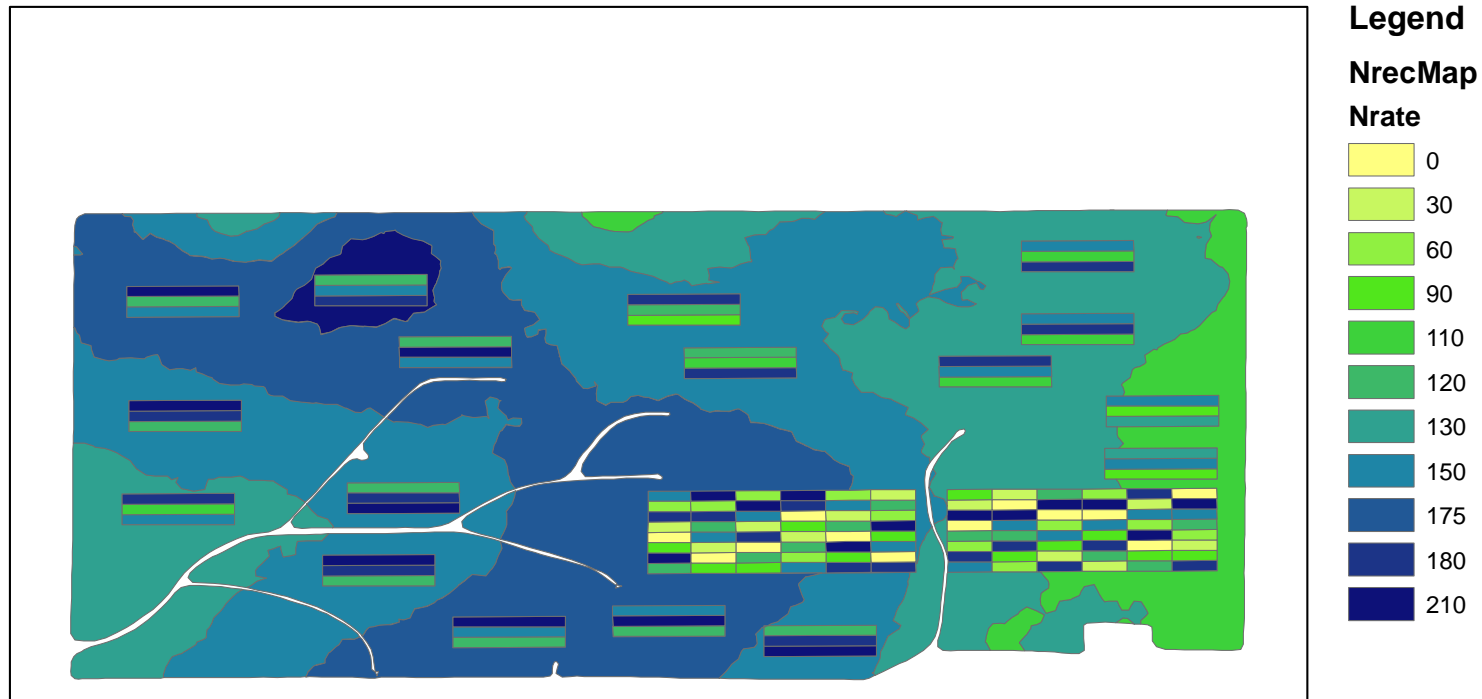
Estimate of N mineralization potential of soil

ISNT Map
based on 2.5 acre samples to 0-12" and 12-24"



Illinois Soil N Test

Variable Rate N Recommendation Map
based on ISNT
designed for developing response curves for field

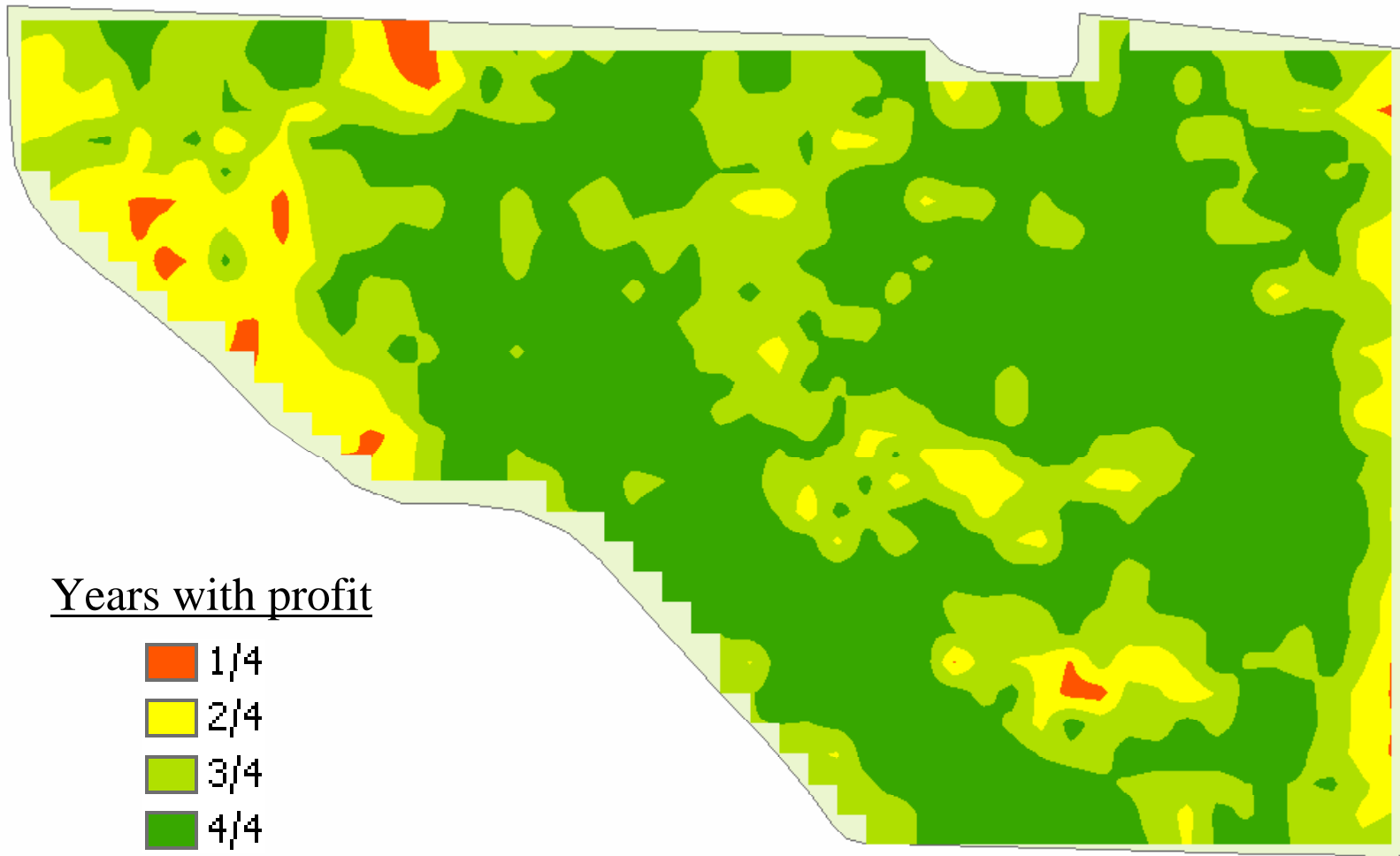


Farmer applied N with VRT based on:

N rate recommended - ISNT

Rate trials and university tests included

WHAT AREAS OF THE FIELD ARE CONSISTENTLY PROFITABLE?



All Crops

WHAT AREAS IN THE FIELD WERE PROFITABLE THIS YEAR?

- Net return:

(yield *map*)(crop price) – total expense *map*

(182 bu/A)(\$2.00/bu) - \$275/A = \$89/A

182 bu/A)(\$3.50/bu) - \$325/A = \$312/A

- Unit production costs:

total expense *map* / yield *map*

(\$275/A) / (182 bu/A) = \$1.51/bu

(\$325/A) / 182 bu/A) = \$1.79/bu

ZONE MANAGEMENT

- Divide fields into areas (zones) of similar need.
- Collect data for each zone...over time.
- Use data to make recommendations and decisions on each zone.
- Determine effects of decisions on each zone.
 - Agronomic effects
 - Economic effects
 - Environmental effects

P RECOMMENDATION

Field Average

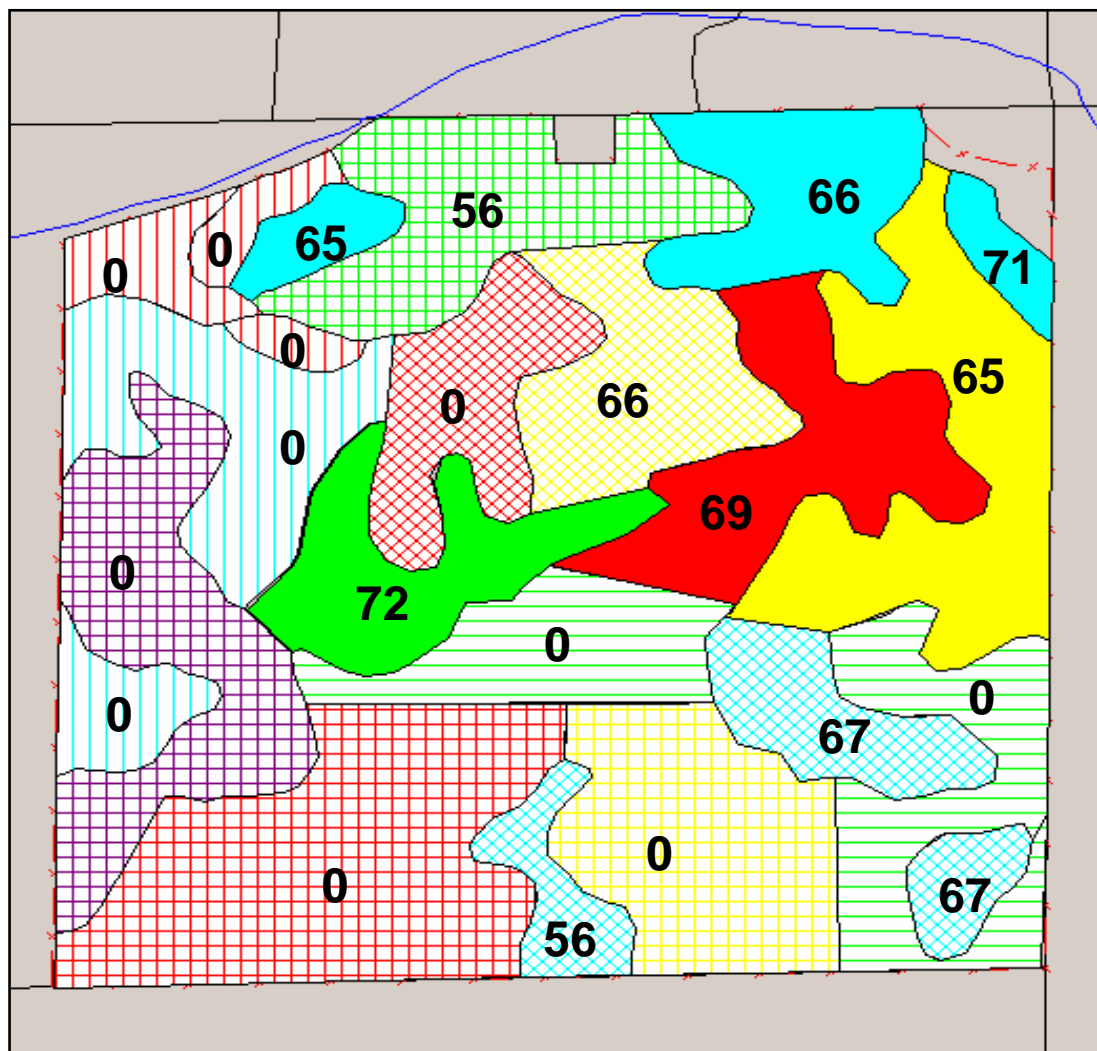
0 P_2O_5

Management Zones

76 Acres

4740 lb P_2O_5

5 Tons of DAP



GAIN FROM TECHNOLOGY

- Nearly **10 tons of P and K fertilizer** sales
- *Yield increase*
— **35 bu/A**
- More efficient use of N and manure
- *A well-managed farm in a “mature market”*



ARE OUR SOIL TEST GOALS ADEQUATE FOR CURRENT SYSTEMS?

Treatment	P ₁ Soil Test	K Soil Test	Corn Yield (bu/A)	P ₁ Soil Test	K Soil Test	Soybean Yield (bu/A)
	(ppm)	(ppm)		(ppm)	(ppm)	
Standard P and K Soil Tests	20	161	152	32	184	57
High P and K Soil Tests	32	237	190	41	222	57

38 bu/A more corn!!



Environmental Benefits of Site-Specific Management Systems



Figure 1. Assessing site vulnerability. Shows the aerial photo with the watershed boundary and the stream channels outlined.



Figure 2. Soil test P distribution. Shows three classes (less than 30, 30 to 100, and greater than 100 ppm) of 0 to 2-inch soil test P overlaid on the watershed.



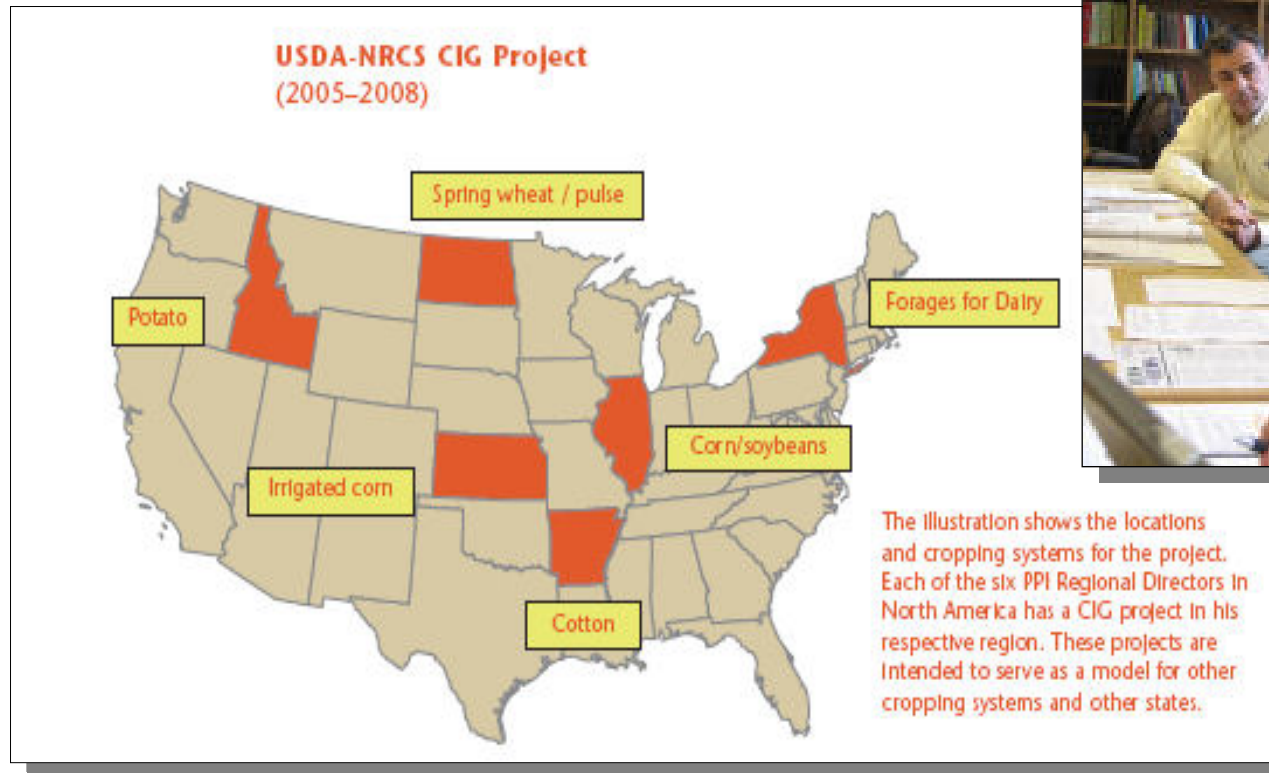
Figure 3. Surface runoff potential. Shows return periods of less than 2, 2 to 10 and greater than 10 years overlaid on the watershed.



Figure 4. Ranking site vulnerability to P loss. Shows low, medium, and high ratings overlaid on the watershed.

FAR PROJECTS: CIG PROJECTS

- *BMPs for Fertilizer Management*
- *2005--3yr project funded by NRCS-CIG*
- *6 cropping systems in 6 states*



INFOAG CONFERENCES

- Experience sharing---*good and bad*---among farmers and their advisers
- *Networking* among participants
 - Farmers, dealers, consultants, academics, etc.
- Continuing education credits (CCA, etc.)

7 National/International Conferences 1995-2005

- Illinois and Indiana

3 Regional conferences

- Tunica, Mississippi, February 2005
- Starkville, Mississippi, February, 2007
- Kennewick, WA, February 2007

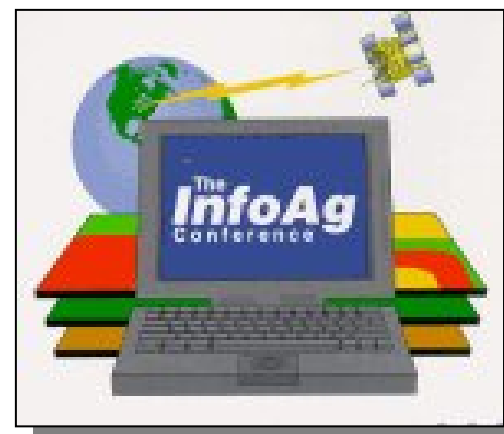
InfoAg 2007

- Springfield, Illinois, July 10-12, 2007



INFOAG CONFERENCES

- Beltsville, Maryland---USDA BARC
 - 2-day conference & exhibits
 - Technology applications---agronomy, economics, environment
 - Agribusiness, CCAs, consultants, farmers
 - 1-day field demonstrations
 - Government agencies, NGOs, congressional staff, media
 - Show & Tell; Ride & Drive
- Link to public field day??
 - 1st Saturday in June
 - Public, students





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President

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Monticello, Illinois 61856

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WWW.IPNI.NET

