Economic Benefits of Soil Survey Information

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Project Summary

- Overall Objective: Develop a comprehensive, defensible assessment of the benefits that accrue to the National Cooperative Soil Survey (NCSS) Program
  - Historical values attributable to the soil survey of the United States
  - Value of continuing to update and maintain the soil survey to support future use
- Funding through USDA/NRCS/NGDC – National Geospatial Development Center

Soil Information

- The NCSS - primary source for collecting and providing soils data for the United States
- Used in diverse fields
  - Agriculture and ranching
  - Forestry and recreation
  - Urban planning and zoning,
  - Site selection for buildings, roads, airports
  - Other purposes

What Is Information?

- Information can be defined as reduction of uncertainty (better understanding of the true distribution)
- Data (factual and numeric)
- Examples:
  - Research results
  - Technology evaluations and new methodology
  - Primary and secondary information

Value of Information (VOI)

- Difference between the value of a project or decision with the information and without the information less the cost of information
- Determined by importance to the decision maker(s) or the outcome of the decision
  - Direct method – ask the decision maker(s)
  - Indirect method – infer value from the results of decisions made with and without the information

Factors Affecting VOI

- Degree of uncertainty of the decision maker
  - How much will more information help?
- What is at stake (value of output)
  - How much could final value be affected?
- Cost of information
- Price of substitutes for the information
  - Are there alternatives?
  - At what cost?

How to Value: Alternative Approaches

- Direct Methods
  - Survey based approaches to valuation
  - Approach accepted in regulation and by the courts for damage assessment and environmental valuation
  - Only approach to develop values for many uses
- Indirect Methods
  - Rely on statistical procedures to capture the impacts on decisions and related outcomes

Does Soil Survey Information affect County-level Corn Yield?

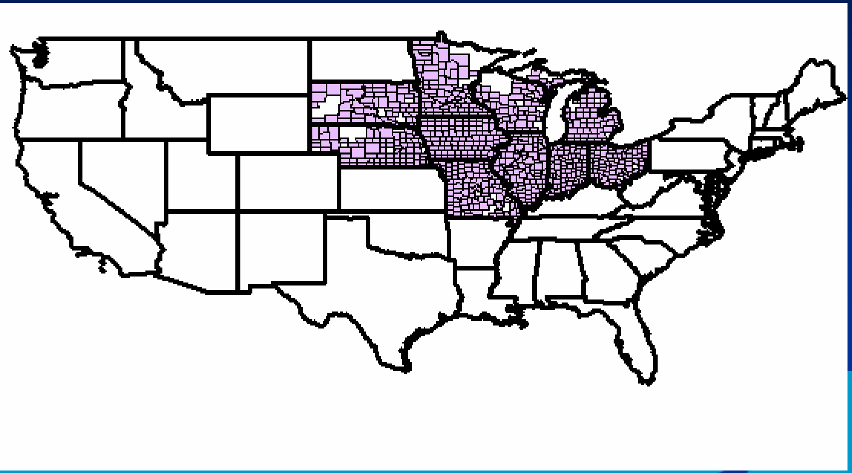
- Implementation of the NCSS provides a natural experiment to test whether soil survey information affects county level corn yield
  - County soil surveys are spatially and temporally dispersed
    - Ongoing in all states in the cornbelt
    - Done at the county level over many years
    - Available to users for a county when completed

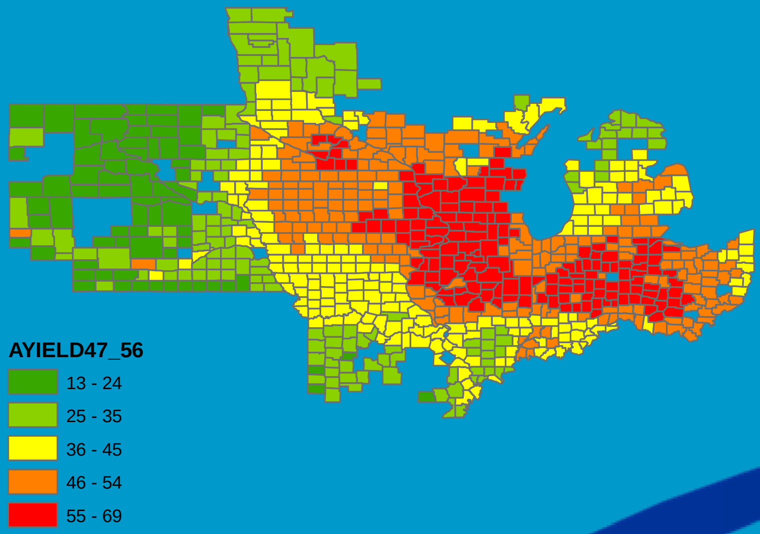
Hypothesis

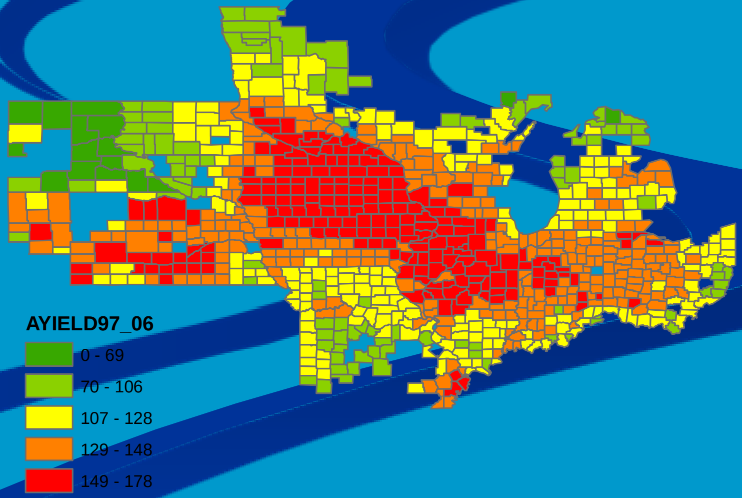
- Yield trends are not affected by availability of soil survey information
- Initial results reject the hypothesis – yield effects appear to very strong – but results are not fully validated

Corn Yield Change

- Study area
- Corn yields increase



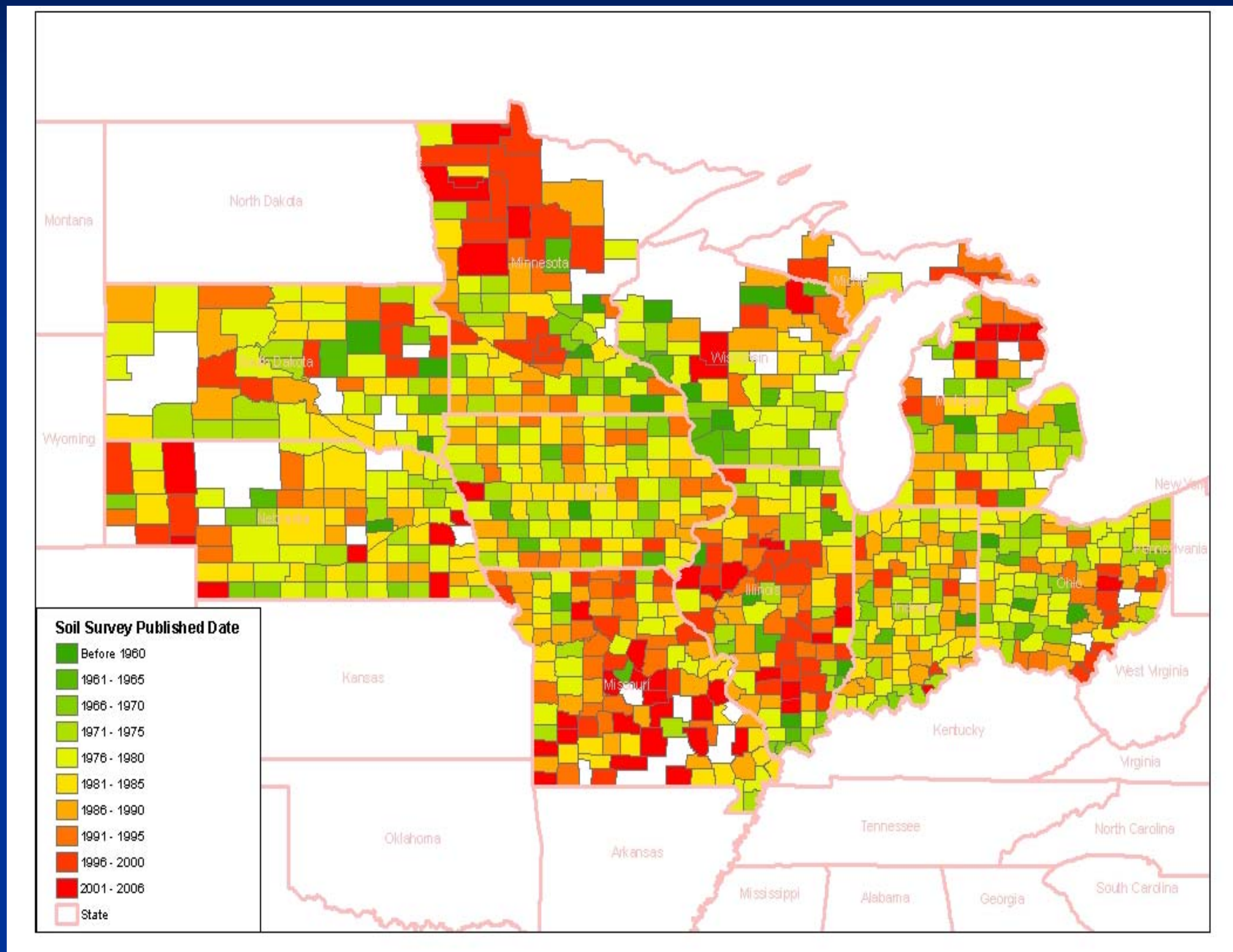




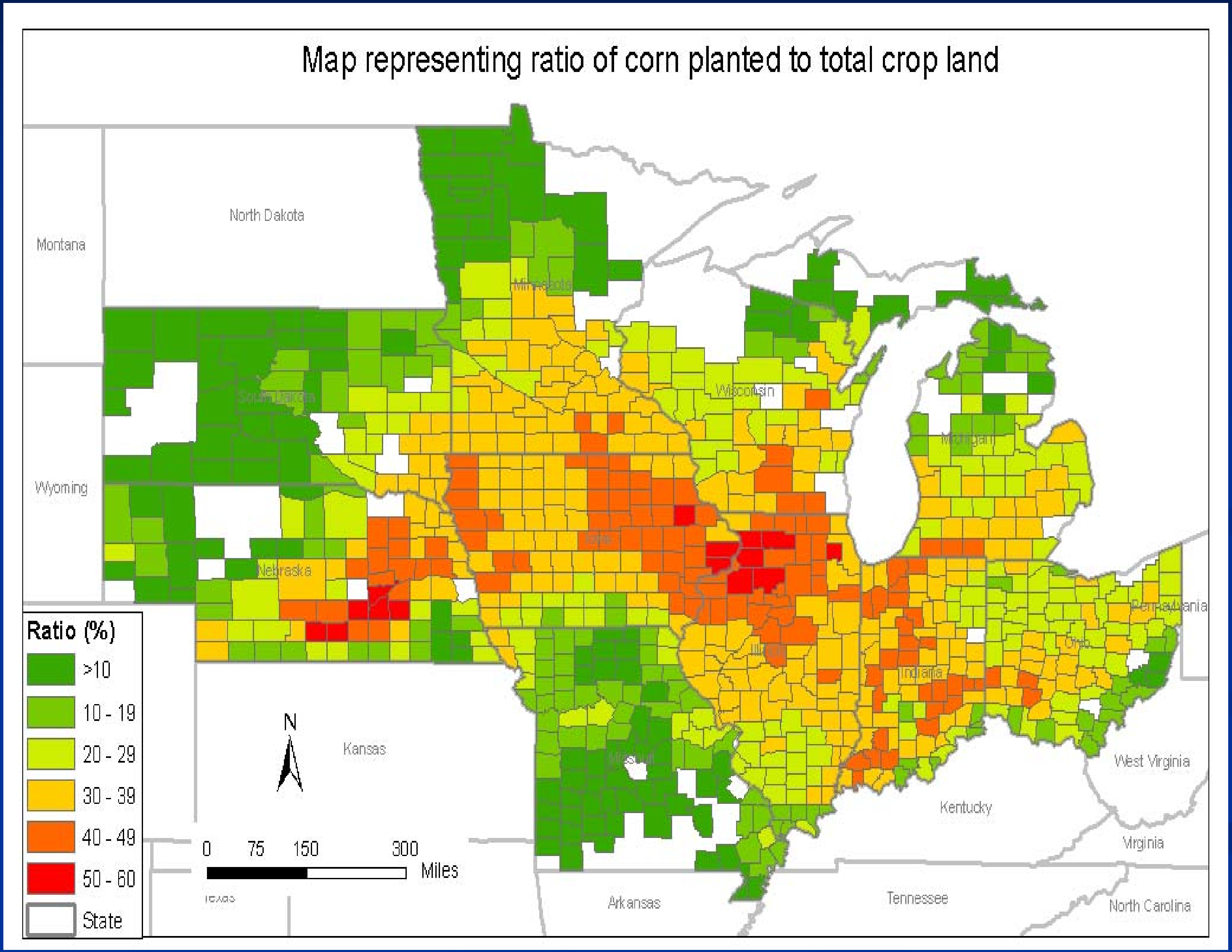
Available Data

- USDA/NASS county-level corn yield data from 1935 to 2007
- Soil survey status data from NRCS publications
- Weather data
- Soil productivity estimates from NRCS simulations models
- Other desired data (but not consistently available)
  - Fertilizer data
  - Hybrid data
  - Technical change

Soil Survey Published Date



Proportion Crop Acres in Corn



Empirical Model

- **General form of model**

  Corn Yield = f (soil info, weather, trend)

- **Preliminary statistical model (panel data)**

$$Y_{it} = dD_i + \sum_j \beta_j T_t^j + \sum_k \beta_k W_{kit} + e_{it}$$

where

Y_{it} = crop yield for county i in year t

D_i = dummy variable for soil survey for county i

T = Time trend (estimate of Taylor series expansion)

W = Weather measure

e_{it} = a random component for county i in year t

Regression Results – Fixed Effects Model (using soil survey correlation date)

Dependent Variable: YIELD
Method: Panel Least Squares
Date: 11/04/07
Sample: 1935 2006
Cross-sections included: 868
Total panel (unbalanced) observations: 60472

Variable	Coefficient	t-Statistic	Prob.
C	222.7	75.1	0
D_SSCORR1	2.5	11.2	0
TREND1	-2.4	-35.8	0
TREND2	0.18	48.6	0
TREND3	-0.0032	-42.9	0
TREND4	2.00E-05	39.5	0
D_1993	-28.7	-52.7	0
JUNE_MNT	0.418	9.5	0
JUNE_MXT	0.00241	0.06	0.9498
JUNE_PPT	-0.383	-3.2	0.001
JULY_MNT	1.38	27.9	0
JULY_MXT	-2.02	-47.3	0
JULY_PPT	3.22	25.1	0
AUG_MNT	-0.187	-4.2	0
AUG_MXT	-1.24	-30.4	0
AUG_PPT	0.459	3.5	0.0005

Next Steps

- **Verify the information on dates of county soil surveys (checking available publications – 2700+)**
  - **Completion date (field work completed)**
  - **Correlation date (mapping units approved)**
    - **In a few cases, precedes the completion date**
  - **Publication date (gap varies from months to years)**
- **Include soil productivity measures as an explanatory variable to capture spatial correlations**

Next Steps (continued)

- Test alternative specifications of the time information becomes available based on the overall explanatory power of the statistical model
  - Completion/Correlation/Publication
    - May include a consistent time shift
- Consider alternative specifications of time to capture temporal trends
  - Technical change, hybrids, fertilizer use, etc.
- Consider alternative functional forms

Initial Conclusions

- Results are promising given the current state of the analysis and data
- The implications for the value of the NCSS for agricultural productivity gains provides information to assist policy makers in assessing the overall value of the NCSS program.

Future Plans

- Continue to develop benefit estimates as appropriate
- Work to develop a more comprehensive approach
- Apply method to soybeans, wheat, cotton

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- Apply method to soybeans, wheat, cotton
- Continue to develop benefit estimates as appropriate
- Work to develop a more comprehensive approach that captures the values of other uses of soil information