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

Map representing ratio of corn planted to total crop land

Ratio (%)
- >10
- 10 - 19
- 20 - 29
- 30 - 39
- 40 - 49
- 50 - 60

State

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Empirical Model

- General form of model
  \[ \text{Corn Yield} = f(\text{soil info, weather, trend}) \]

- Preliminary statistical model (panel data)

\[ Y_{it} = dD_i + \sum_j \beta_j T_{ij} + \sum_k \beta_k W_{kii} + e_{it} \]

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

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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