Tools to Address the Intersection of Economics and the Environment

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In: Addressing the Intersection of Economics and the Environment in Future Food Systems Breakout Sessions
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10:30 AM-Noon & 1:00 PM-2:30 PM

*The views are those of the author and should not be attributed to the USDA or the Economic Research Service
Research helps us understand and support sustainable food systems

• What do we know about current levels of adoption of conservation practices in the U.S.?
• Research gaps and the role for interdisciplinary studies
• Data for research on conservation systems and sustainable agriculture
• Research informs science-based policy and extension
How many U.S. farmers are using conservation practices?

<table>
<thead>
<tr>
<th>Practice</th>
<th>Adoption Rate</th>
<th>Year</th>
<th>Data Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cover cropping</td>
<td>&lt;2% of corn, soybean, wheat, and cotton acreage</td>
<td>2010-2011</td>
<td>USDA Agricultural Resource Management Survey</td>
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<td></td>
<td>8.6% of farms with cropland and 2.9% of cropland acres</td>
<td>2012</td>
<td>USDA Census of Agriculture</td>
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<tr>
<td>No-till/strip-till</td>
<td>34.6% of acres in no-till (for which tillage practices are reported)</td>
<td>2012</td>
<td>USDA Census of Agriculture</td>
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<td></td>
<td>39% of corn, soybean, wheat, and cotton acreage in no-till/strip till</td>
<td>2010-2011</td>
<td>USDA Agricultural Resource Management Survey</td>
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<tr>
<td>Split N application</td>
<td>64% of cotton acres</td>
<td>2007 (cotton)</td>
<td>USDA Agricultural Resource Management Survey</td>
</tr>
<tr>
<td></td>
<td>31% of corn acres</td>
<td>2010 (corn)</td>
<td>USDA Agricultural Resource Management Survey</td>
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<td>Testing for soil organic matter</td>
<td>11% of oat fields and 15.8% of cotton fields surveyed tested at least once in last 10 years</td>
<td>2015</td>
<td>USDA Agricultural Resource Management Survey</td>
</tr>
</tbody>
</table>

Source: adapted from Wade et al. (2015) and Bowman et al. (2016)
No-till adoption has increased over the past 20 years

• Between 1994 and 2012, the number of acres in no-till expanded from 39 million acres (Source: CTIC) to around 96 million acres (USDA Census of Agriculture)

• Some of the factors driving the expansion:
  – Seed and planter technology
  – Conservation compliance rules for highly erodible land
  – Conservation financial and technical assistance
Adoption of conservation practices varies regionally: no-till

Source: USDA Economic Research Service using data from the 2012 Census of Agriculture
Policy focus has expanded to cover crops

- Between 2006 and 2016, EQIP annual spending on cover crops grew from $3.1 million to more than $48 million (USDA-NRCS, ProTracts Database)
- Between 2006 and 2016, the number of acres receiving EQIP payments for cover cropping more than quadrupled (from 240,418 to 1,120,311; USDA-NRCS, ProTracts Database)
- Cover crop enhancements available through Conservation Stewardship Program (CSP)
Adoption of conservation practices varies regionally: cover crops

Source: USDA Economic Research Service using data from the 2012 Census of Agriculture
Beyond adoption of single practices....where are the research gaps?

Impact of practice or system adoption on....

• Agronomic outcomes (yield, soil quality, nutrient availability, pest and weed pressure)
• Economic outcomes (e.g. input use/cost, profitability, risk)
• Environmental outcomes (e.g. nutrient runoff, water quality, soil carbon sequestration, resource use)
• Public benefits that arise from any of the above

Potential benefits of interdisciplinary research.
Beyond adoption of single practices....where are the research gaps (con.)?

What are the barriers to adopting conservation practices or transitioning to more sustainable systems?

• Where—and why—might it be unprofitable for farmers to adopt a new practice or system?

• Role of uncertainty and risk in farmer decision-making

• What types of information do farmers need to make decisions, and what types of policies and programs are effective in overcoming information barriers?
Policies and programs can help lower barriers to adoption

- Incentives for testing/monitoring of soil health or environmental outcomes
- Extension, outreach, training, and technical support can reduce information barriers and learning costs
- Conservation programs that provide financial incentives can address multiple barriers
- Insurance—so long as practices are compatible with RMA and FSA programs, risk may be partially mitigated
- Research can help address multiple barriers
Economic research on policies and programs informs whether they work as intended and are cost-effective

• When a farmer participates in a financial assistance program, is adoption additional?

• When a farmer participates in a financial assistance program for a management practice (e.g. no-till or cover crops), do they continue with the practice after the contract ends?

• What roles do information and technical assistance play, and what sources are trusted and used by farmers?
Data tools available to address these questions

- National survey data
- Administrative data
- Satellite data
- Private data
- Public/opportunistic data (e.g. citizen science data)
- **Case studies** (NRCS, NCAT/ATTRA, and others)
- SARE/CTIC surveys
Economic case studies for research and outreach

• Strength: Accessible to farmers, and gives a specific example they can identify with
• Strength: Relatively low-cost
• Weakness: Difficult to generalize results due to lack of statistical validity and inherent selection bias
• Weakness: Diversity of methods can make it difficult to compare results across case studies
Survey data on conservation practices and systems

• Strength: Very detailed and statistically representative data
• Strength: Surveys such as Ag Census and Agricultural Resource Management Survey (ARMS) are national in scope
• Weakness: Difficult to assess economic changes over time due to changes in management practices if surveys are not designed to be panel surveys
• Weakness: Linking surveys to data on prior program participation (e.g. EQIP) can be difficult
• Weakness: If practice is not widely adopted (e.g. cover crops), may have low statistical power
Remotely-sensed data

• Strength: greater spatial coverage relative to survey data
• Strength: Can track same point or field over time
• Weakness: Less precision than sampling or surveying—are we actually measuring what we think we’re measuring?
• Weakness: Limited frequency of satellite passes and cloud cover can lead to “holes” in the data.

Potential *complement* to survey or administrative data?
Example: integrating satellite and administrative data in the Northern Plains

• Research questions:
  – What happened to fields that received EQIP payments for no-till after their contract ended?
  – Did no-till contracts have any impact on neighboring farms or fields (spatial spillovers)?

• Use satellite imagery to develop estimate of field residue, and combine with administrative data on EQIP no-till contracts, SSURGO data on soil and topography
Study area focused on the boundaries between SD/ND and SD/MN – 150,000 sq km

Source: USDA Economic Research Service and Roger Tory Peterson Institute
Using multiple imagery dates improved coverage

Overlapping areas have increased temporal coverage without changes in satellite settings

Source: USDA Economic Research Service and Roger Tory Peterson Institute
Integrating satellite and administrative data in the Northern Plains (con.)

- Preliminary results suggest some persistence, spatial spillovers
- The existence of either has implications for EQIP and other financial assistance programs
- Continuing work to look at larger geographic area—also working to extend to cover crops
Summary

• We know rates of adoption for some conservation practices in the U.S., but know less about adoption of multiple practices or more complex systems
• Interdisciplinary studies can contribute to our understanding of how conservation systems impact the environment, on-farm profitability, and off-farm benefits
• Diverse data sources for research on conservation systems and sustainable agriculture, but each has strengths and weaknesses
• Research can inform policy and program decisions
• Using “big data” or satellite data may be a complement to survey data (but not necessarily a substitute)
Questions

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