



United States Department of Agriculture

# 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  
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# 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?

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

Source: adapted from Wade et al. (2015) and Bowman et al. (2016)

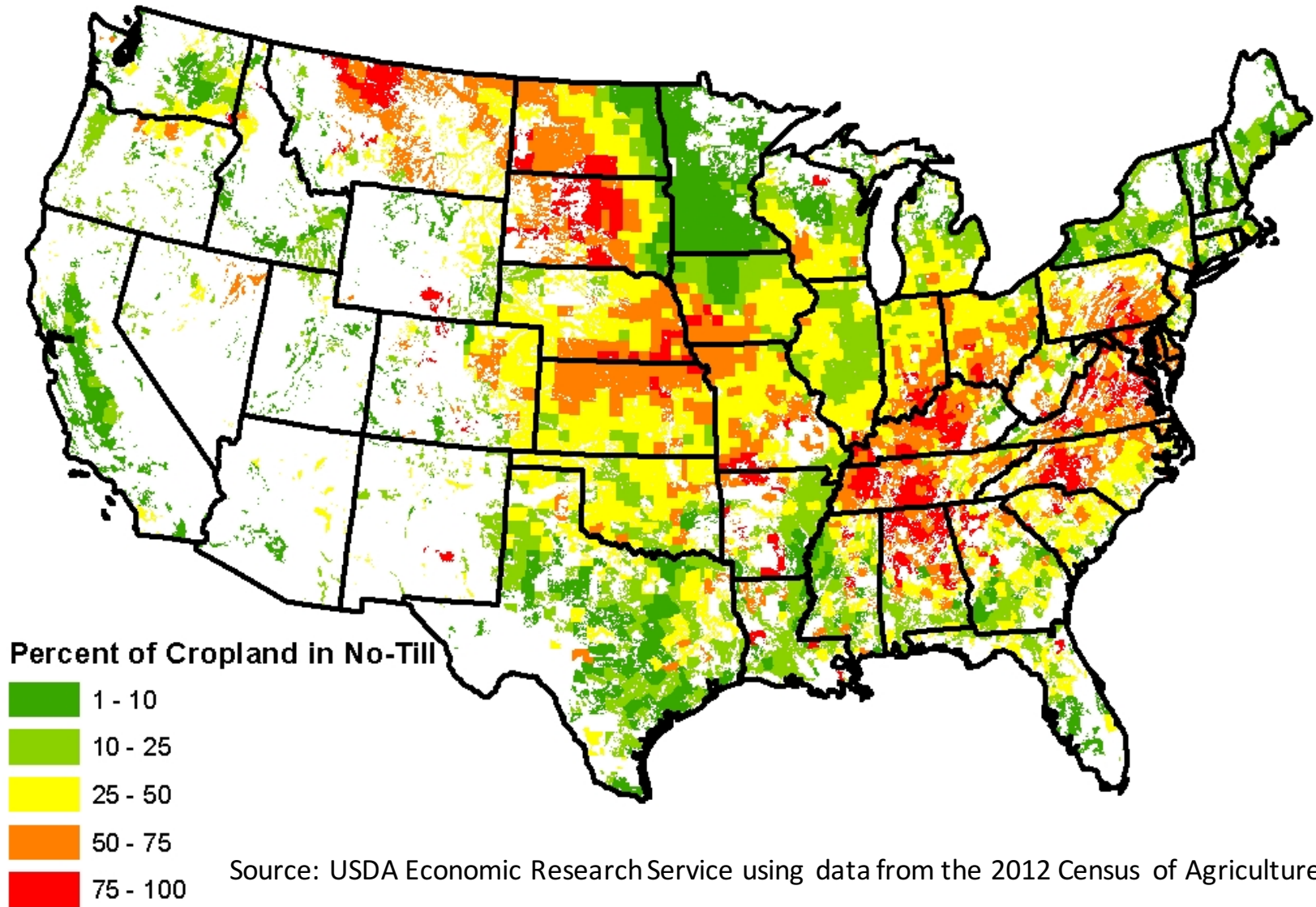


# No-till adoption has increased over the past 20 years

- 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



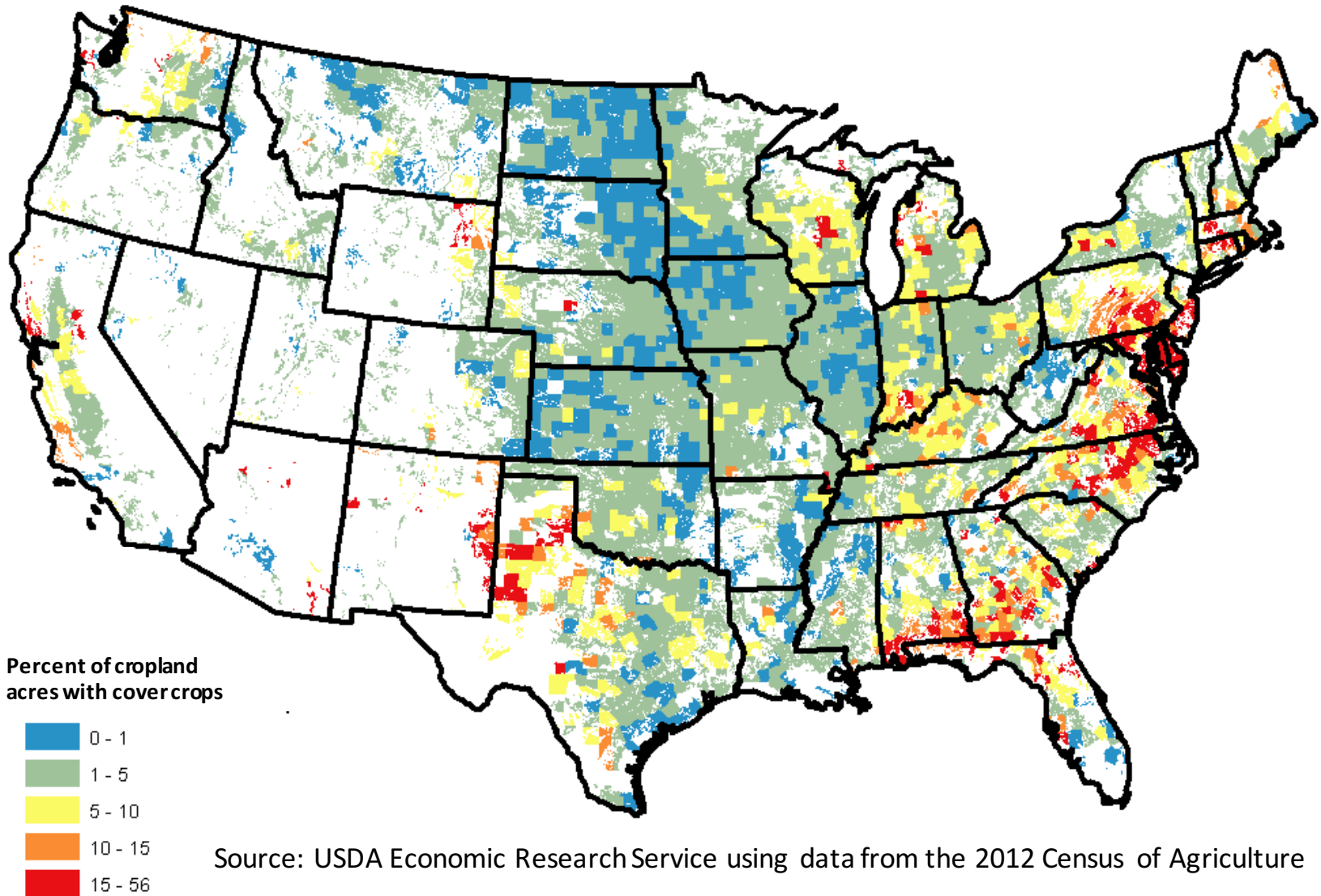
## Policy focus has expanded to cover crops

- 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?

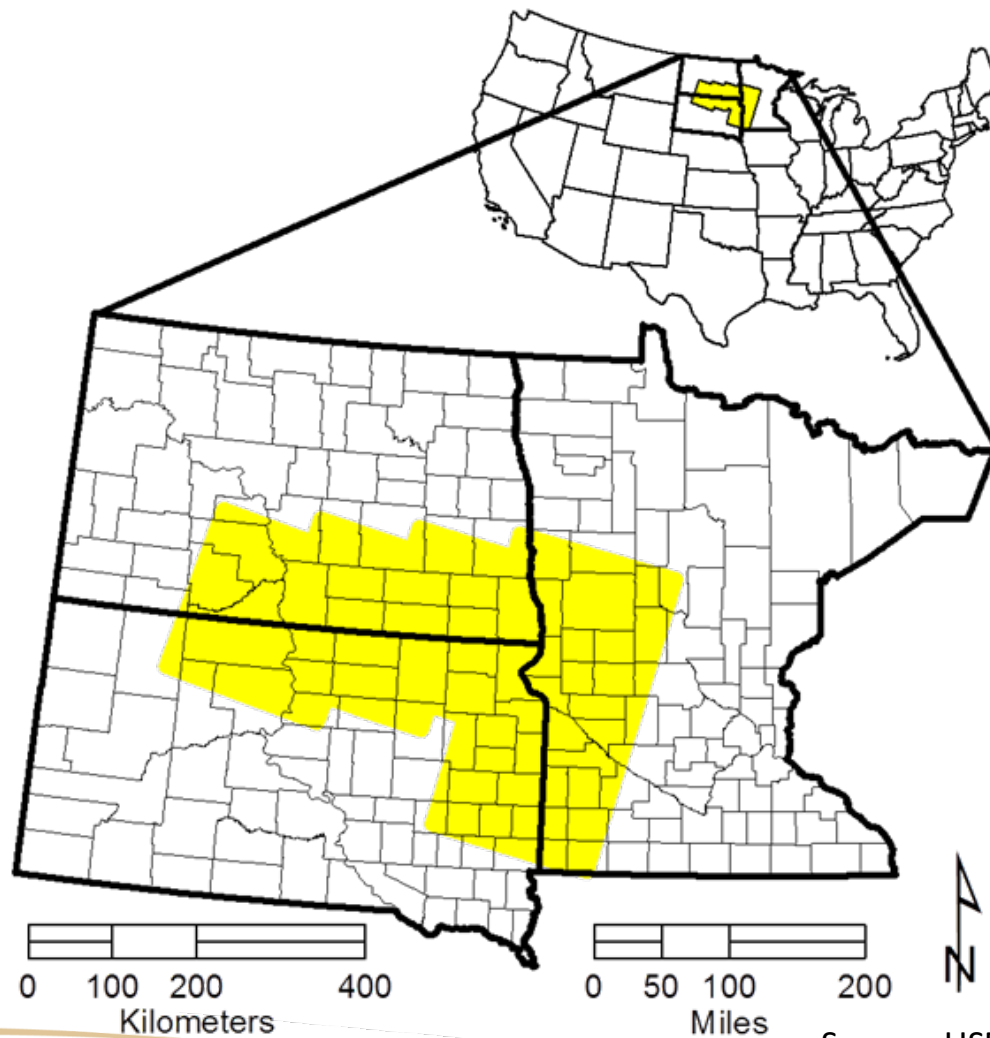


# Example: integrating satellite and administrative data in the Northern Plains

- 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



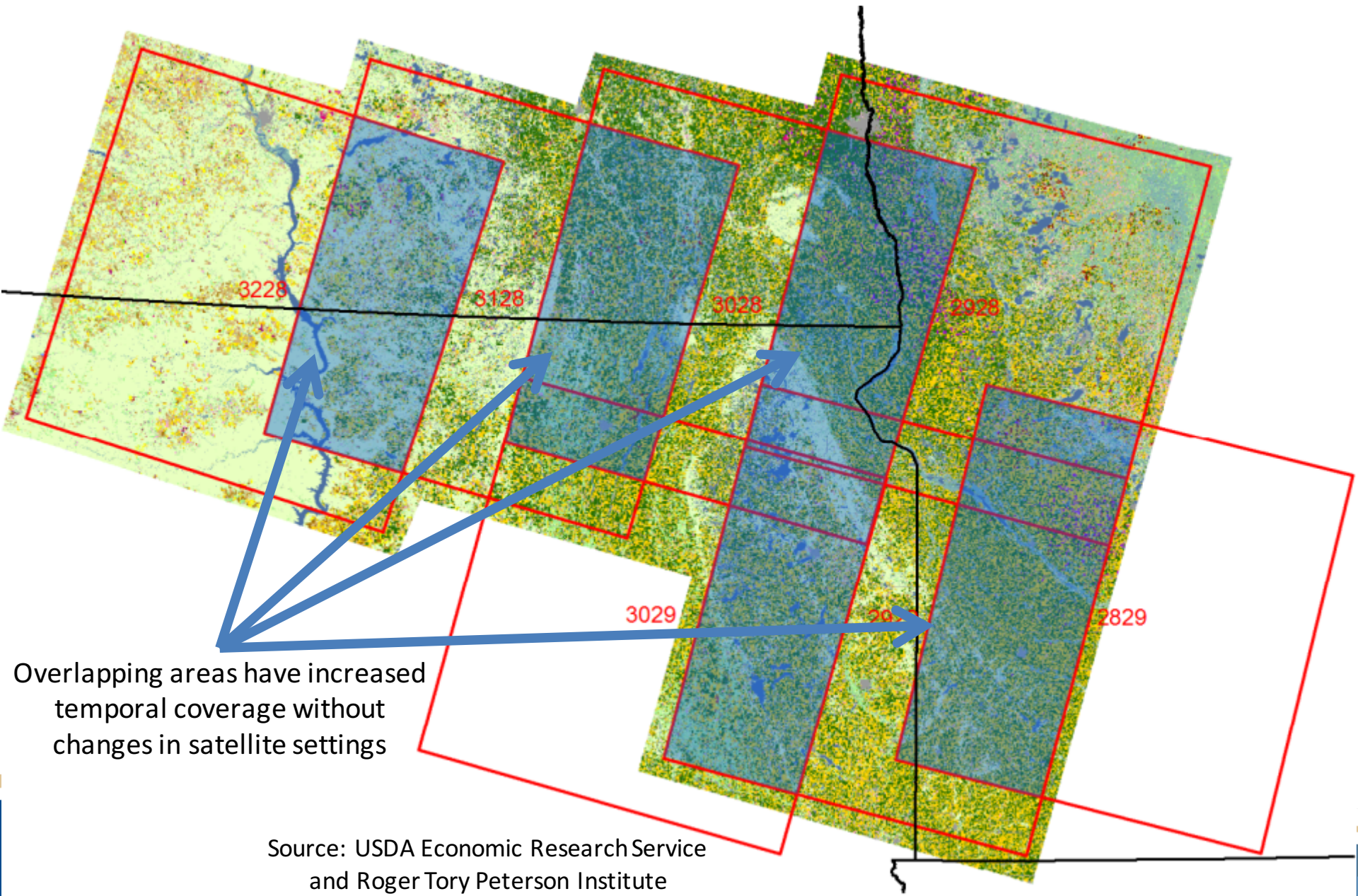
# Study area focused on the boundaries between SD/ND and SD/MN – 150,000 sq km



Source: USDA Economic Research Service and Roger Tory Peterson Institute



# Using multiple imagery dates improved coverage



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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# References

- Bowman, M., S. Wallander and L. Lynch. 2016. An Economic Perspective on Soil Health. *Amber Waves*, September, 2016. <https://www.ers.usda.gov/amber-waves/2016/september/an-economic-perspective-on-soil-health/>
- Wade, T., R. Claassen, and S. Wallander. 2015. Conservation-Practice Adoption Rates Vary Widely by Crop and Region. Economic Information Bulletin No. 147. USDA Economic Research Service, Washington, D.C. [https://www.ers.usda.gov/webdocs/publications/44027/56332\\_eib147.pdf?v=42403](https://www.ers.usda.gov/webdocs/publications/44027/56332_eib147.pdf?v=42403)

