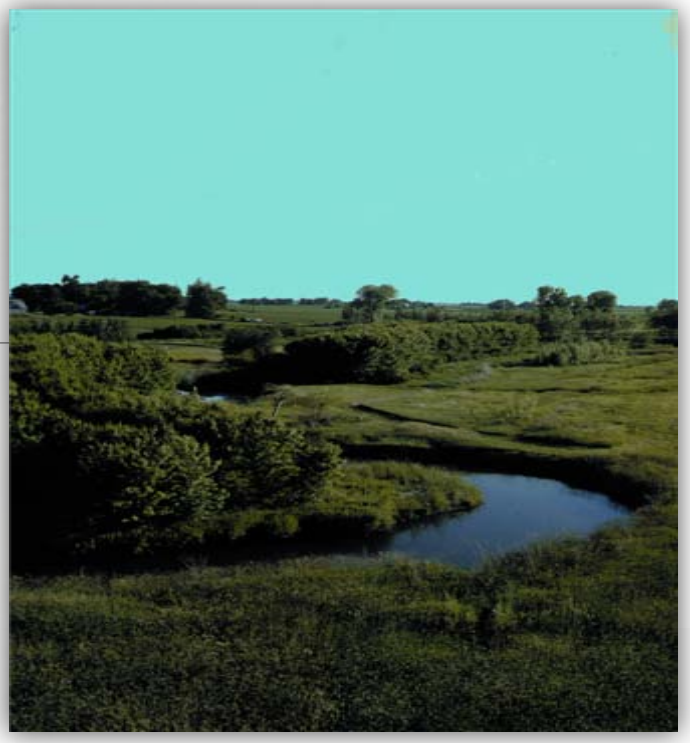
Using Old and New Technologies in Conservation Agriculture to Improve Water Quality

CHAD WATTS, CONSERVATION TECHNOLOGY INFORMATION CENTER

CTIC



CTIC champions, promotes and provides information on technologies and sustainable agricultural systems that conserve and enhance soil, water, air and wildlife resources and are productive and profitable.

A Public/Private Partnership

Members

Corporations, **Institutions** (media, commodity groups, conservation organizations, associations), **Individuals**

Advisors & Partners

Federal agencies, universities, extension, research institutions

The Fertilizer Institute
Nourish, Replenish, Grow

INDIANA SOYBEAN ALLIANCE

SACKETT

Illinois Corn Growers Association

GROWMARK

Agri Drain CORPORATION

The Nature Conservancy
Protecting nature. Preserving life.

JOHN DEERE

NATIONAL CORN GROWERS ASSOCIATION

MONSANTO

Agricultural Retailers Association

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syngenta

ASA American Soybean Association

BAYER
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Agrium

Mosaic

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Simplot

INDIANA CORN

CropLife AMERICA

CTIC Conservation Technology Information Center

DOW
Dow AgroSciences

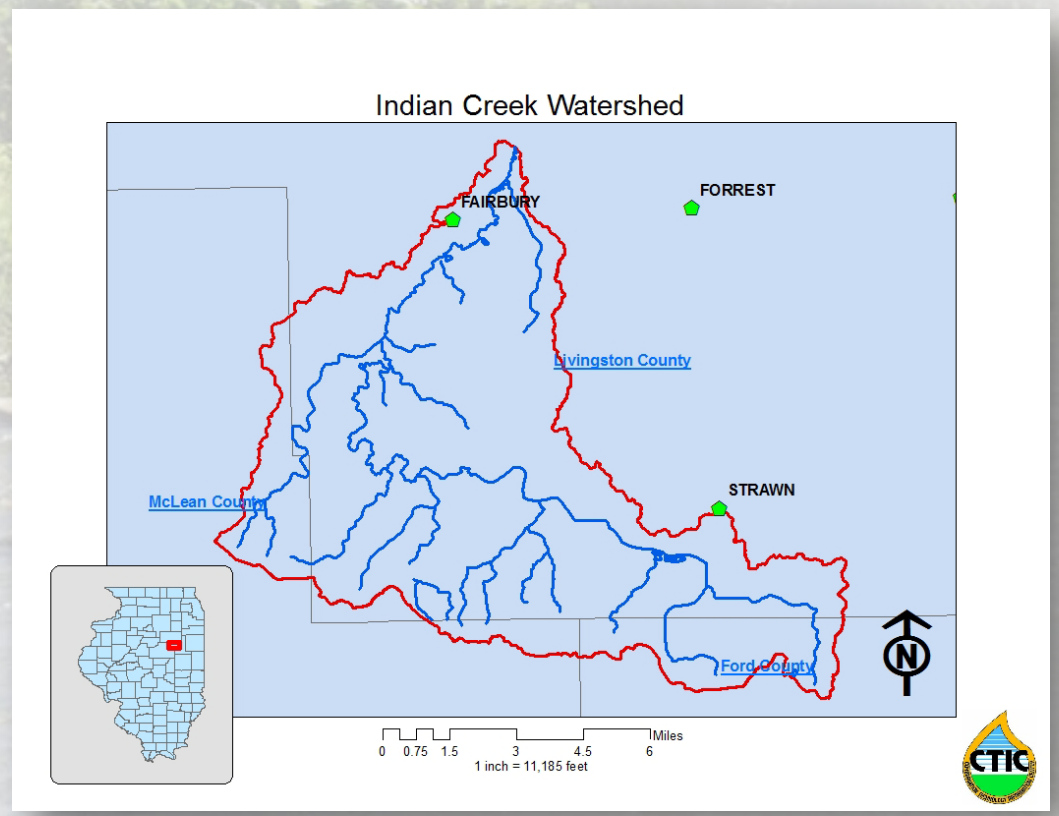
What I will talk about today

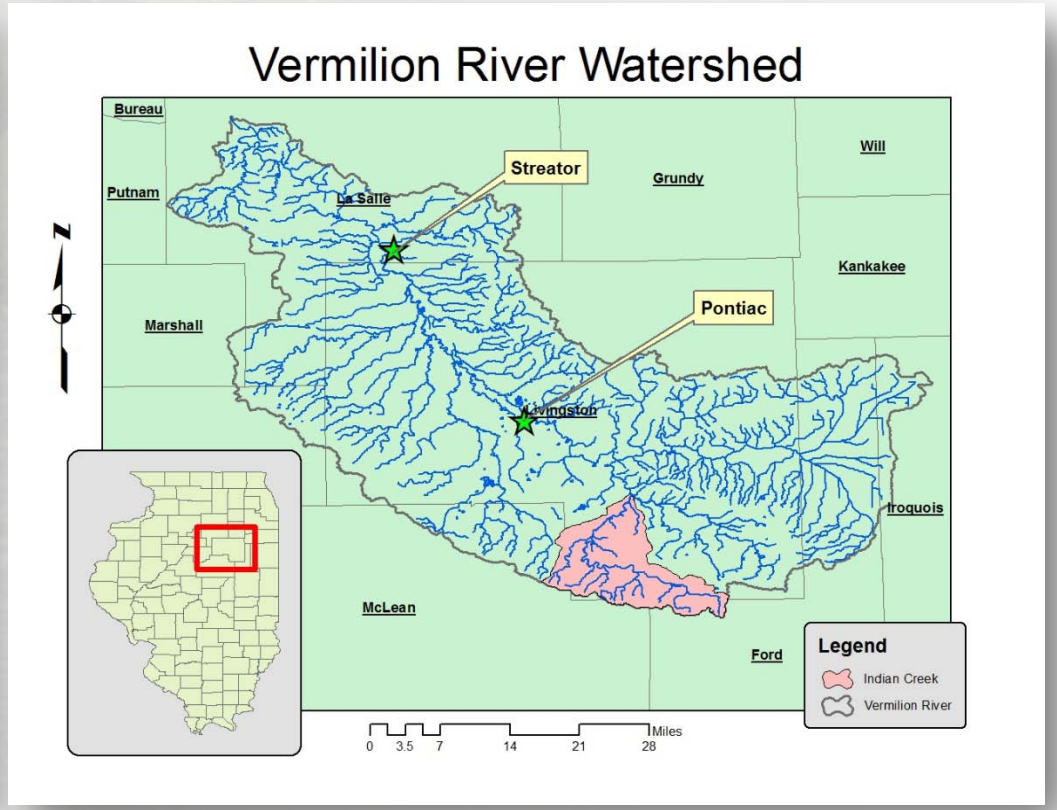
- Protecting water quality in Indian Creek watershed in Illinois
- Gathering Information about cover crops
- Measuring tillage practices and cover crops

Indian Creek Watershed – Selection Criteria

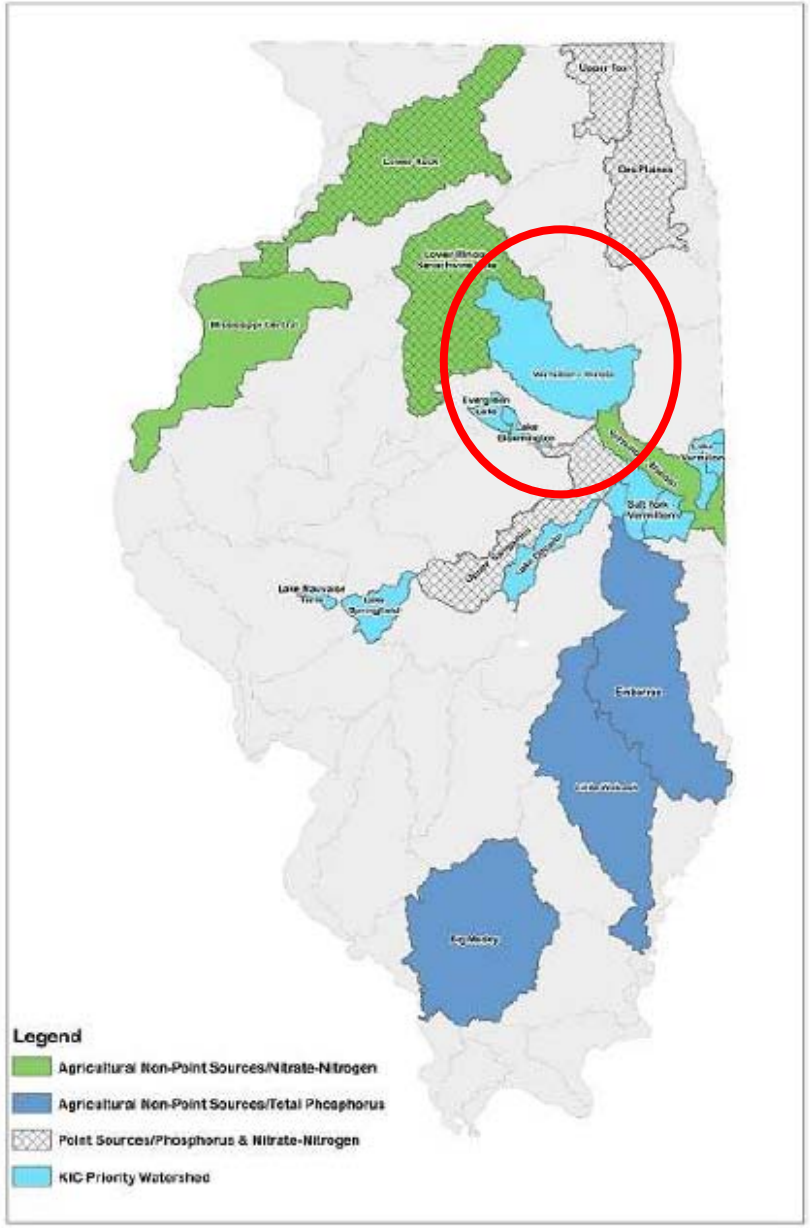
- Small watershed
  - Ability to provide outreach to all producers
  - Ability to make a difference in water quality
- Strong Local Partner
  - Provides on-the-ground credibility
- Documented water quality issue
  - Something around which to galvanize the community

Indian Creek Project





Illinois Nutrient Loss Reduction Strategy



Indian Creek Goals

Provide support to watershed farmers

- Social Support
- Technical Support
- Educational Support

A farmer and community-led watershed conservation effort

Encourage voluntary use of conservation practices and systems on at least 50% of the acres in the watershed

- We want to determine if that scale of implementation can make a difference in water quality

4R Nutrient Stewardship

RIGHT SOURCE

Matches fertilizer type to crop needs.

RIGHT RATE

Matches amount of fertilizer to crop needs.

RIGHT TIME

Makes nutrients available when crops need them.

RIGHT PLACE

Keeps nutrients where crops can use them.

Indian Creek … By the Numbers

5+ - Number of years the Indian Creek project has been in existence

6 – Number of steering committee meetings held each year

25+ - On-farm demonstrations done in Indian Creek

55+ - Percentage of land in Indian Creek watershed impacted by Conservation

75 – Approximate attendance at Winter Meetings

104 – Number of farmers in the Indian Creek watershed

125 – Approximate attendance at summer field tours

25,000 + - People drinking water from the Vermilion River

52,000 – Approximate acreage of Indian Creek Watershed

Indian Creek Partners

Indian Creek Steering Committee

Industry Partners and Sponsors

Livingston County
Soil & Water Conservation District

Working with Partners

Partners are the one of the keys to success in Indian Creek watershed

- SWCD, NRCS and Local partners
- Bring technical expertise and relationships with local farmers

NGO Partners

- Bring critical principles to the table to help with the project
- 4R concept is the basis for our on-farm demonstration program

Industry Partners

- Bring products, practices and best practices to the project that we can use to implement nutrient strategies

Sponsors and Contributors

C-BMP
Illinois Council on Best Management Practices

Fishers & Farmers Partnership for the Upper Mississippi River Basin

ILLINOIS SOYBEAN ASSOCIATION

BASF
We create chemistry

Agri Drain CORPORATION

Mosaic

MONSANTO

Illinois Corn Marketing Board

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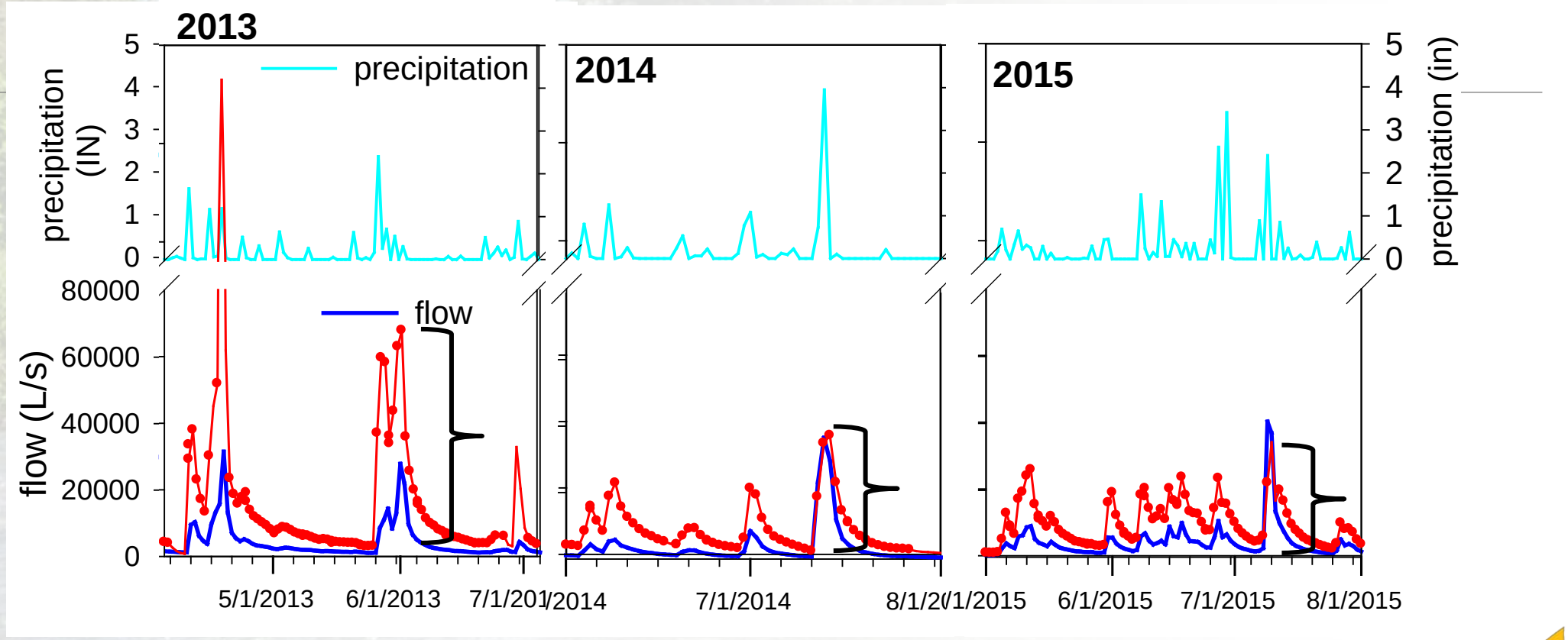
SACKETT EQUIPMENT
Technology and Equipment for the World Fertilizer Industry
THE A. J. SACKETT & SONS COMPANY

Indian Creek Water Quality Data Analysis

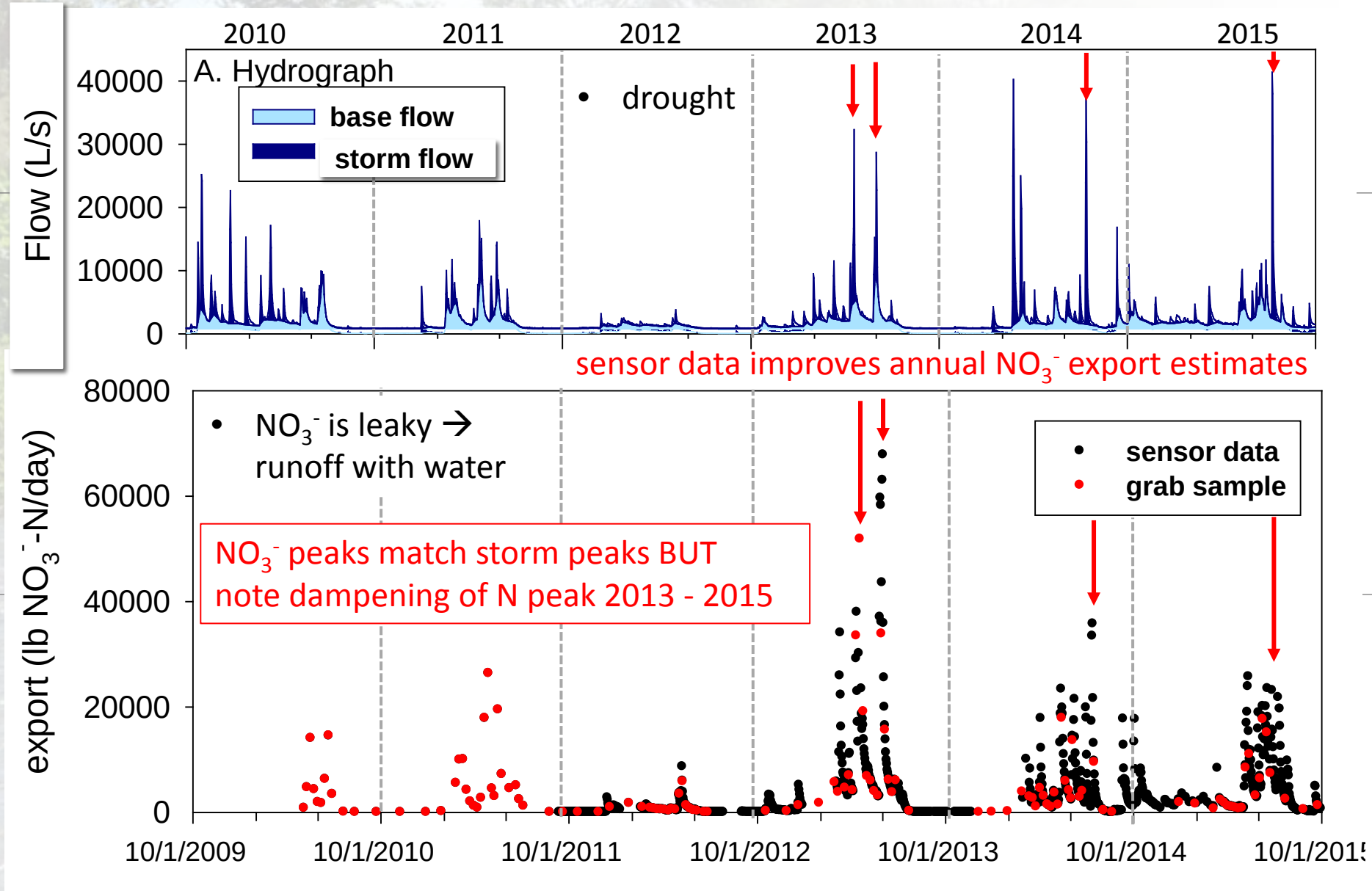
ANALYSIS DONE BY NOTRE DAME UNIVERSITY FROM DATA COLLECTED BY USGS AND IL EPA.

BMP implementation has potential to reduce NO_3^- export during storms

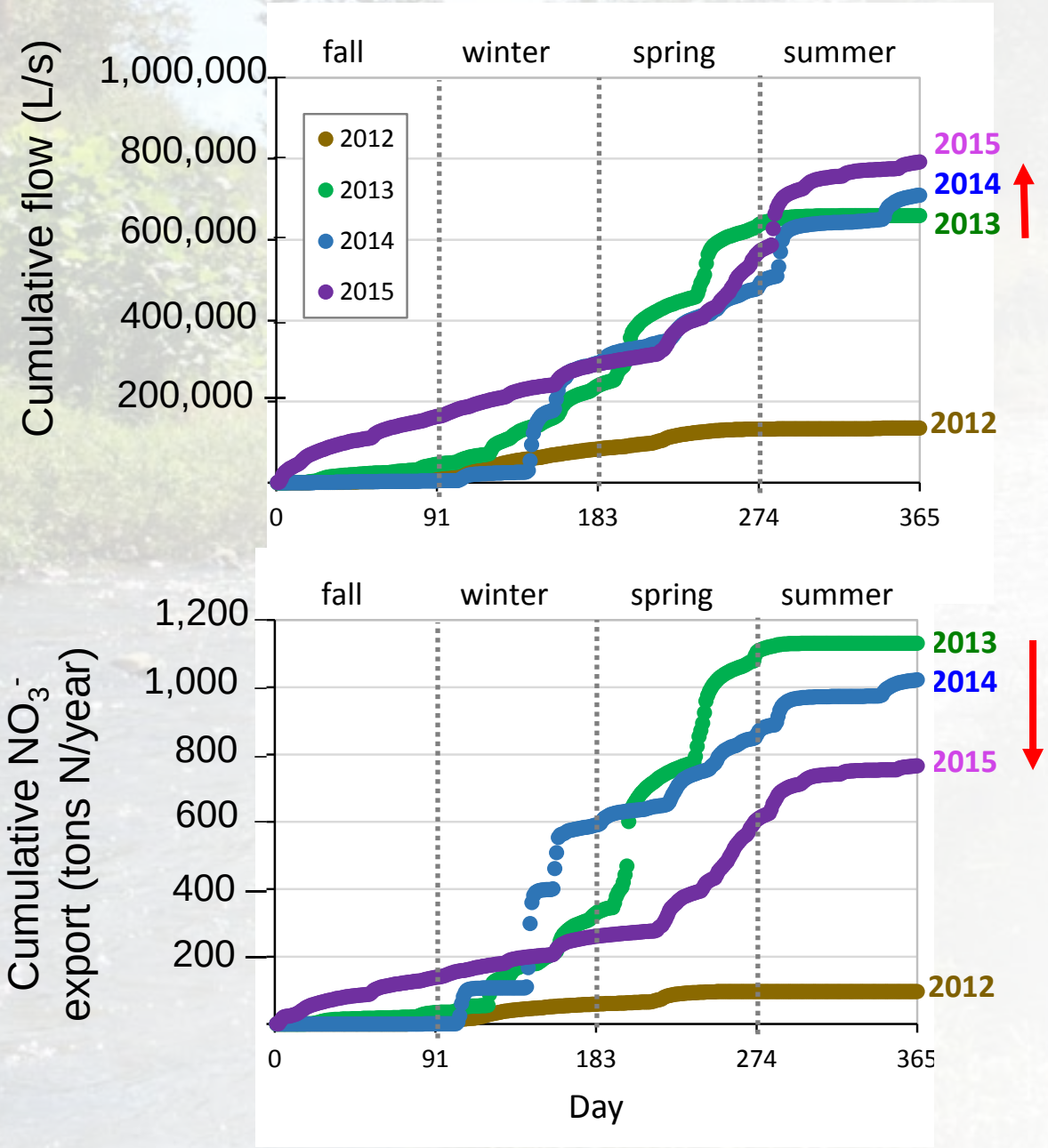


- Compare multiple storm events late spring/early summer
- **Precipitation & flow** : 2015 slightly > 2013
- **For similar size storms, NO_3^- export 2013 > 2015**

Timing of peaks in NO_3^- export match peaks in flow



Cumulative NO_3^- export decreased over time



- **Cumulative export**
  - Add daily export for given day + all previous days
  - Gradual ↑ during base flow
  - Periodic ↑ sharp during storms
- **Flow**: Similar for non-drought years (slight ↑ 2013 to 2015).

- **Cumulative annual NO_3^- export ↓ from 2013 to 2015.**

Indian Creek - Summary

- This project provides a model and framework for engaging local citizens, government agencies, NGOs, commodity organizations, and ag industry companies in a water quality project of local significance
- This project is an example of building the local capacity to address conservation objectives
- This project is a model of how to engage farmers and local citizens in efforts to locally important waters
- This project shows hope that voluntary use of priority BMPs can make a difference in water quality if implemented at a sufficient scale.

Indian Creek

- This project can be replicated, under the right conditions, to achieve similar success at building capacity and engaging local citizens

Cover Crop Survey

CHAD WATTS, CTIC PROJECT DIRECTOR

Partners

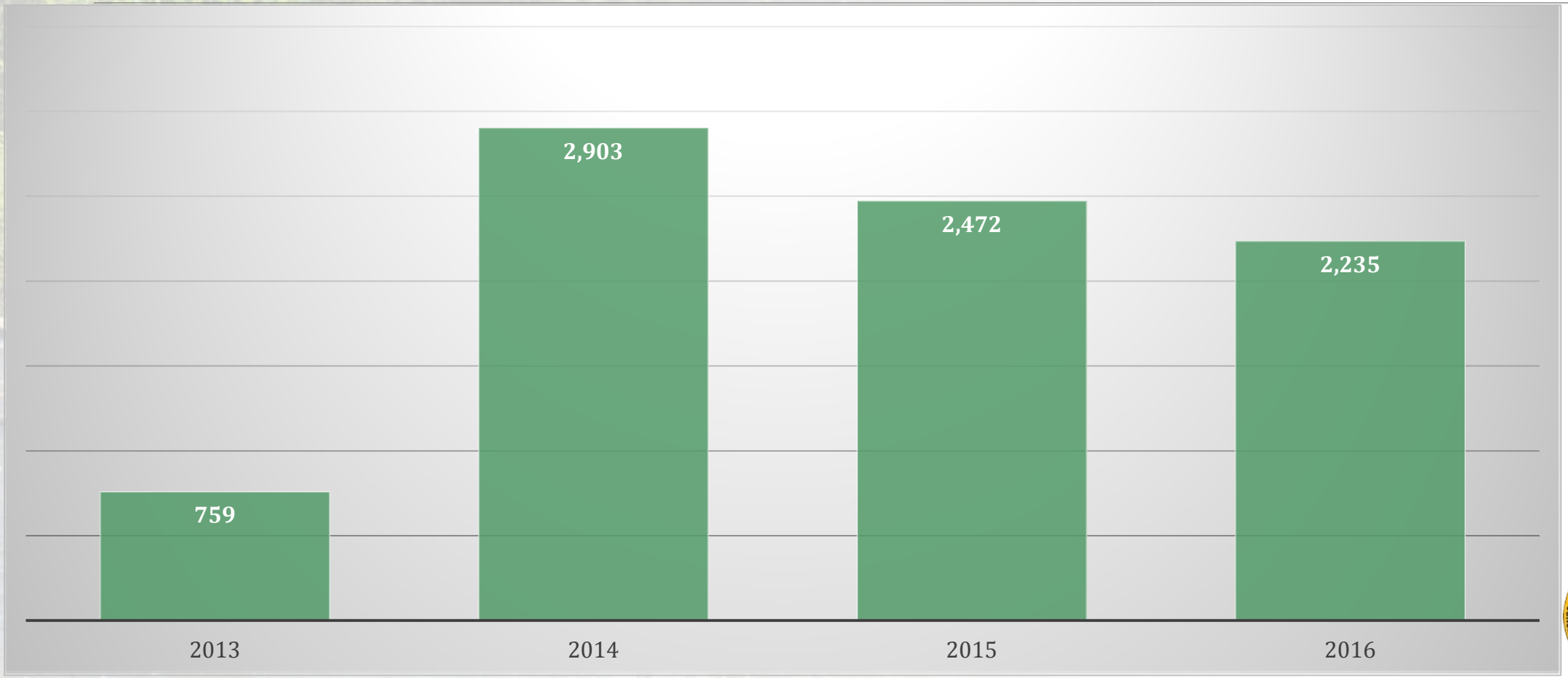

NORTH CENTRAL
SARE
Sustainable Agriculture
Research & Education


asta
American Seed
Trade Association

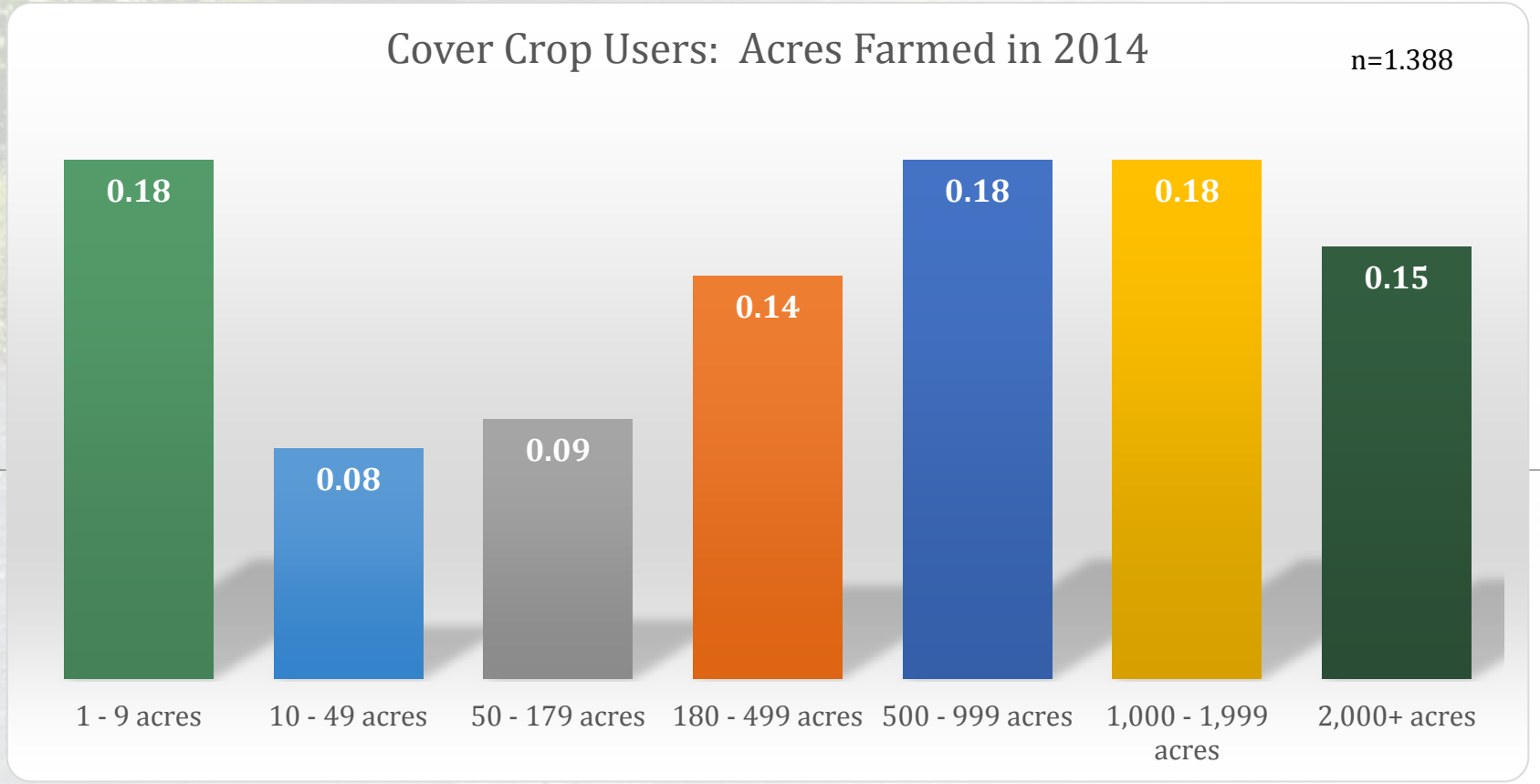
Survey Goals

- Learn how farmers are using cover crops and gain some insight on adoption trends
- Gain insight into why cover crop non-users are not using cover crops
- Have yield and other information helpful for guiding cover crop policies and regulations
- Develop information about how farmers learn best about cover crops and how best to encourage the use of cover crops

Total Respondents by Year

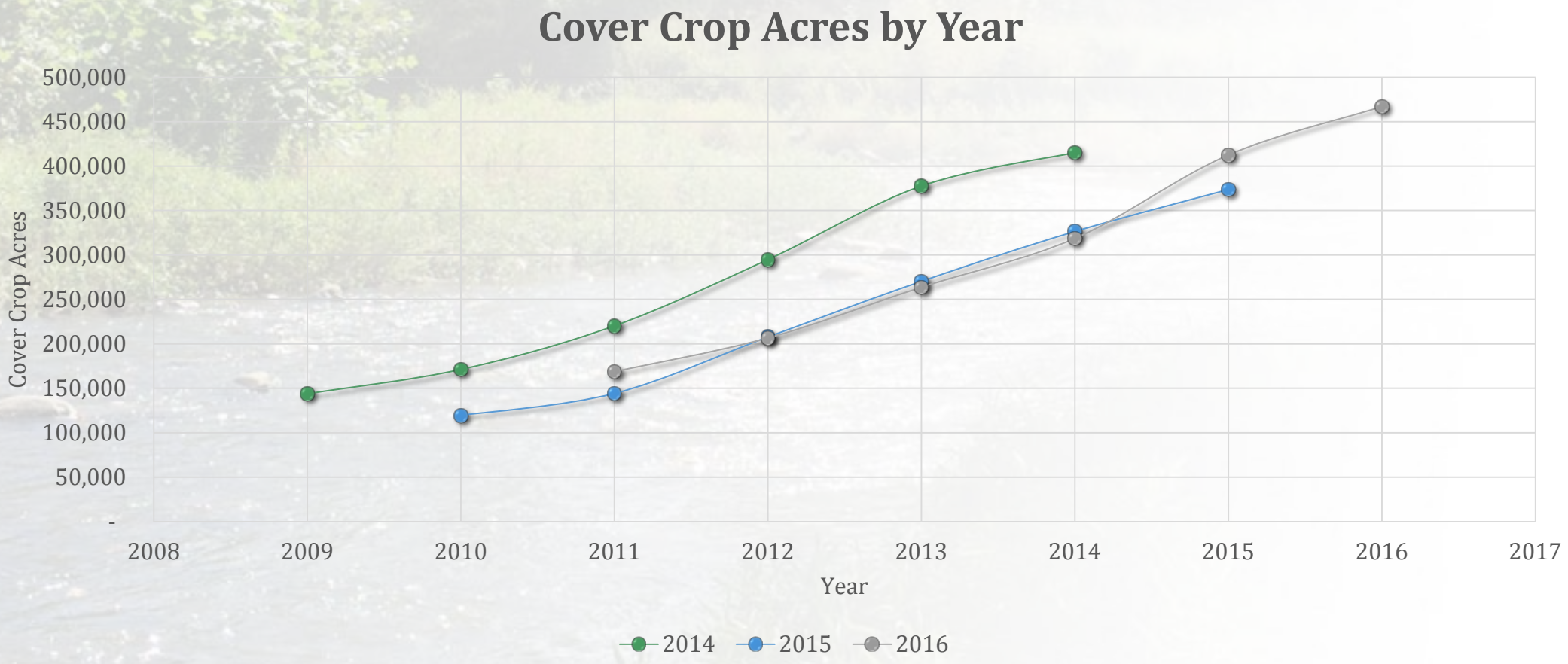


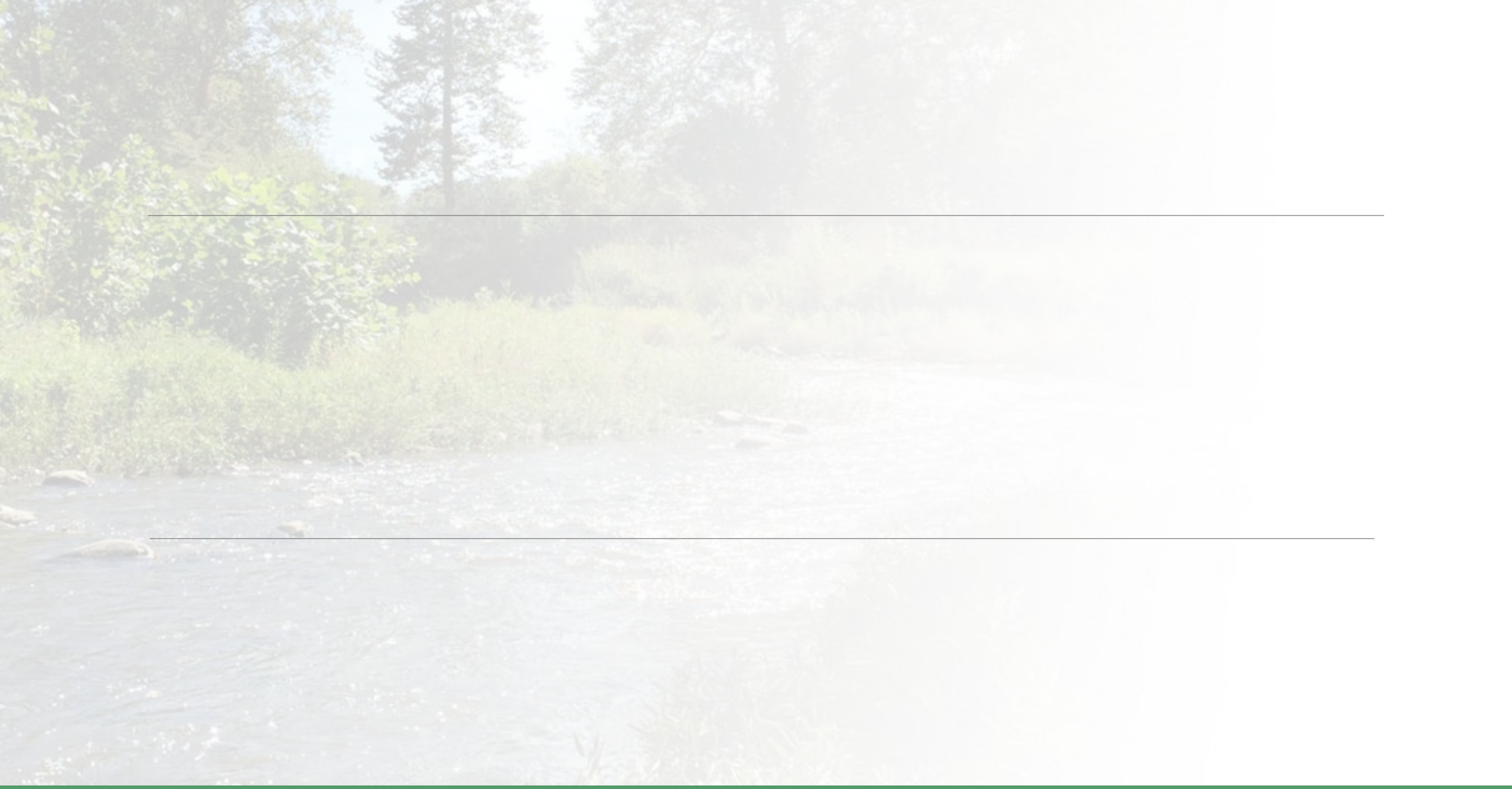
How many acres did cover crop users farm in the 2014 cropping season?



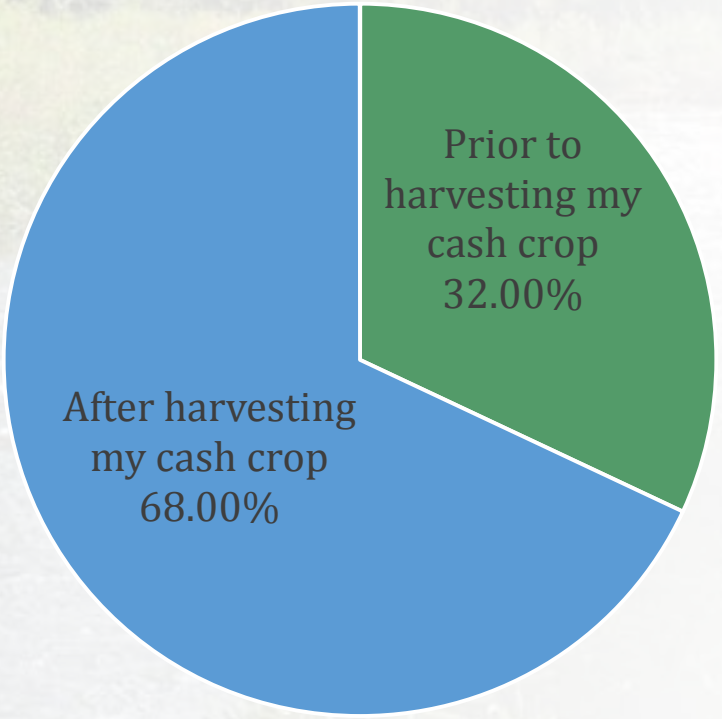
n=1,388

Cover crop acres



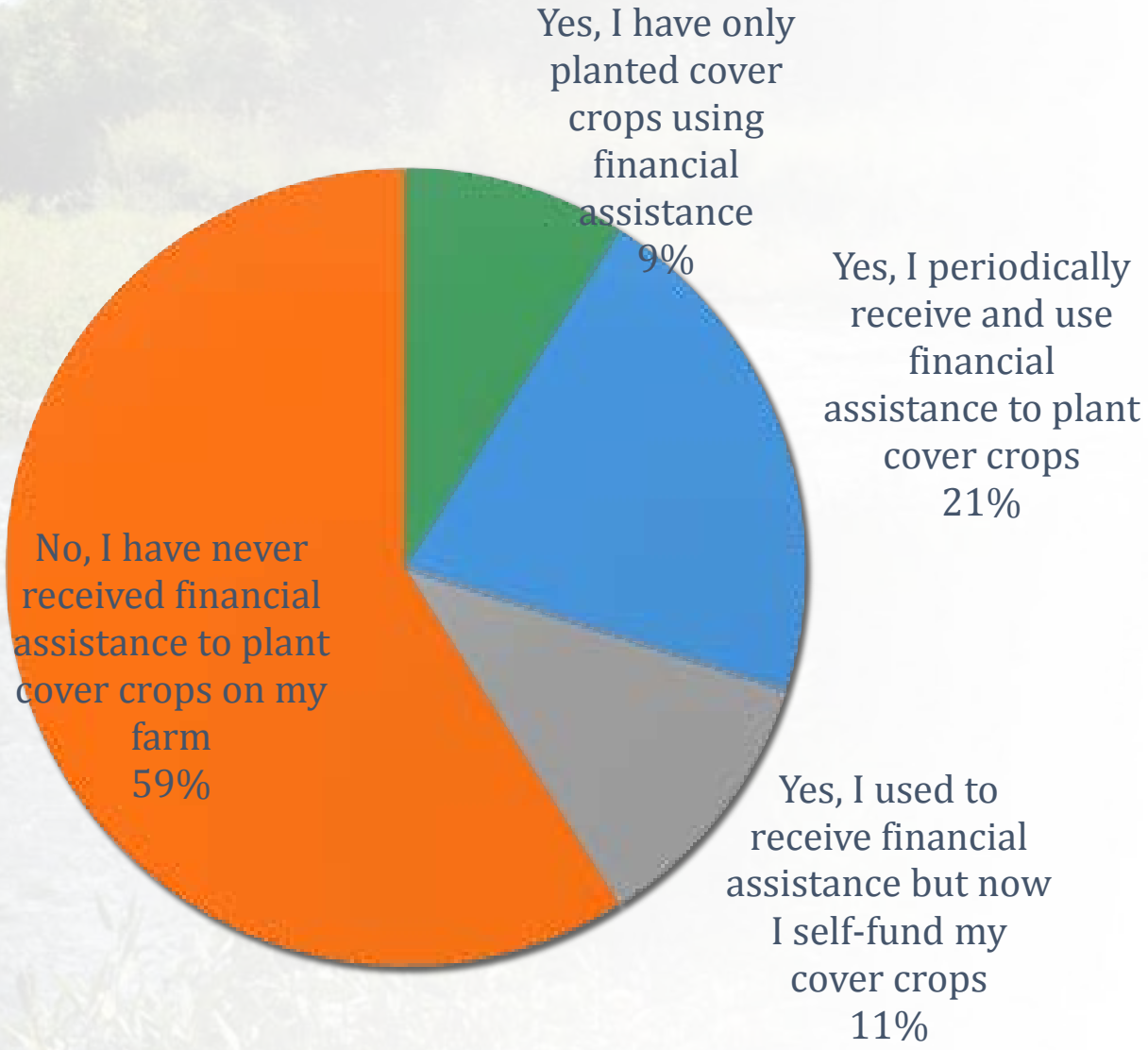


When are the majority of your cover crops planted in relation to harvest? Row crop producers



n=720

Have you received cost-share assistance or incentive payments to plant cover crops?



n=1,089

Uses of survey information

Information from the Cover Crop survey has been used for many purposes, including:

- Focusing cover crop research dollars
- Guiding demonstrations
- Shaping educational and outreach efforts
- Influencing policy regarding cover crops and crop insurance

Statistics from the survey have been used in the following places:

- Quoted by NRCS Chief Jason Weller during a Capital Hill briefing
- Our survey was also referenced in a New York Times Article - *"Cover Crops, a Farming Revolution with Deep Roots in the Past."*

Relevance to Water Quality Improvement

- A key strategy to help farmers address nutrient losses
- We can apply what we learn to improve adoption
  - Improved, more focused educational efforts
  - Improved technical assistance to farmers to get them what they need
  - Better understanding of how cover crops are used
  - Better knowledge of why farmers are not using cover crops
  - More focused research
  - More understanding policies
  - Better integration of cover crops into cropping systems

A New Approach to Surveying Tillage Practices and Cover Crops

Applied · Geosolutions

Project Sponsors and Partners

A History of Collecting Tillage Data

1989 – 2004 CTIC facilitated the collection of on-the-ground tillage data at a national level

- Windshield surveys were done by local NRCS, Conservation Districts and other partners
- Survey was conducted in over 3,000 agricultural counties
- CTIC database is still the most robust data set of its kind

Existing satellite-based approaches are promising, but are limited in the way they have been implemented:

- typically single area for a single time period
- often reliant on information from a single satellite

What is OpTIS?

OpTIS – Operational Tillage Information System

A remote sensing-based survey system that can automate the estimation of fractional crop residue cover on US Cropland

- Estimates tillage types and amount of tillage taking place
- Also highlights the timing of tillage based on multiple aerial photographs

Also can detect the presence / absence of cover crops

- Uses aerial photography to separate cover crops from winter grains

CTIC and AGS are looking to refine the technology and determine the feasibility of using it on a larger scale

Currently

Piloting the OpTIS technology in Indiana

- Evaluating accuracy, repeatability and cost

CTIC and AGS are looking to refine the technology so that it can be used on a larger scale across the agricultural US

Using data collected by Indiana partners

- Verifying OpTIS measurements
- Assessing accuracy
  - Using on-the-ground, verified measurements

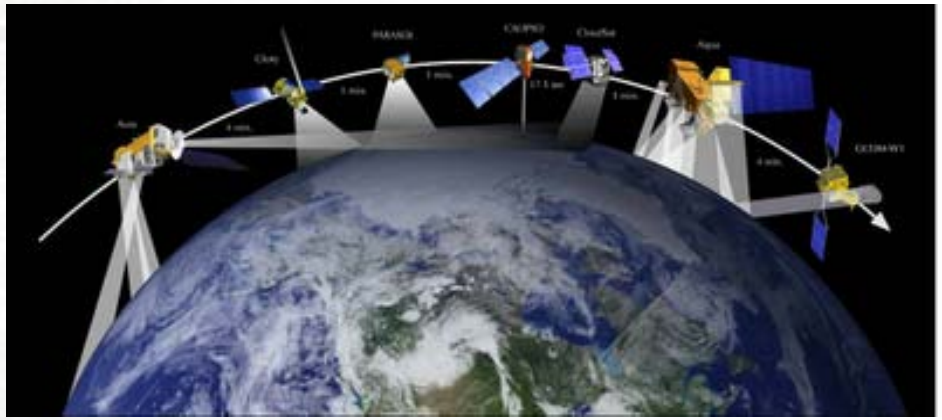
First test of OpTIS at this scale

Using Available Data

To map crop residue cover and the presence of cover crops across wide regions and through time, we rely on multiple sources of data:

- Data and imagery from multiple satellites is being used to improve coverage and accuracy

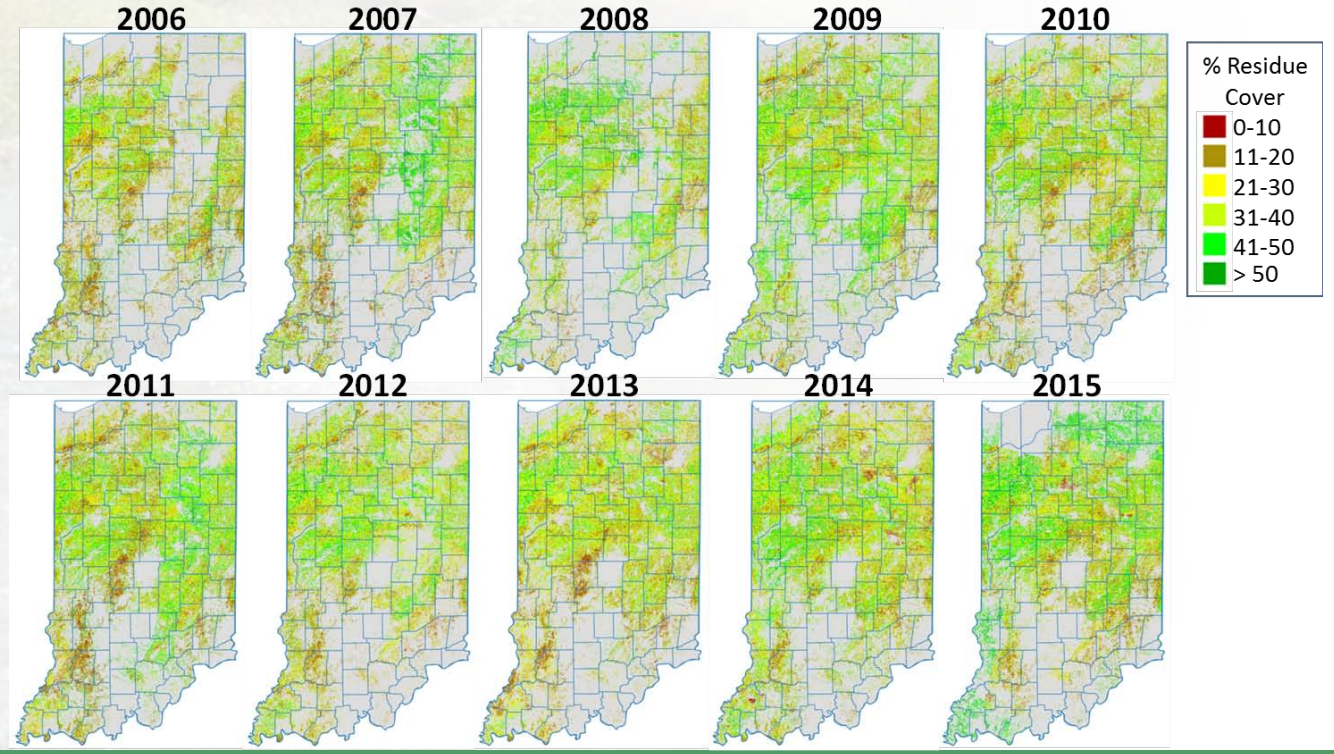
- Weather data
  - Atmospheric moisture
  - Soil moisture
- Ground measurements (for validation)



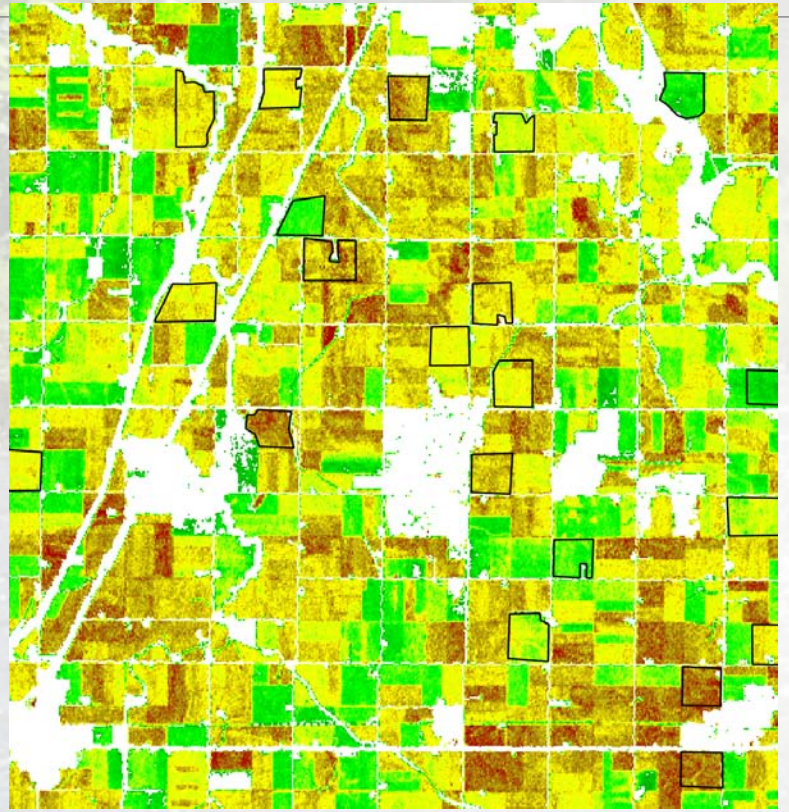
Creating Useful Products

The OpTIS system provides detailed maps of **crop residue cover** and **cover crops**:

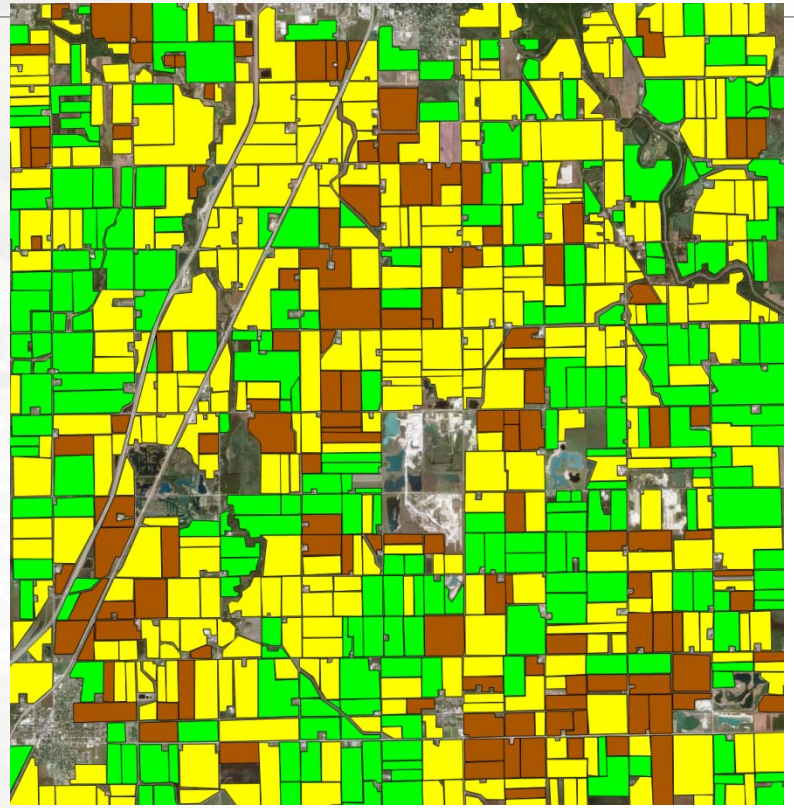
- ✓ Tillage in Fall & Spring
- ✓ Annually
- ✓ Farm-field, county, & watershed level
- ✓ Uncertainty maps
- ✓ Trends
- ✓ Continuous no-till



Estimating Residue



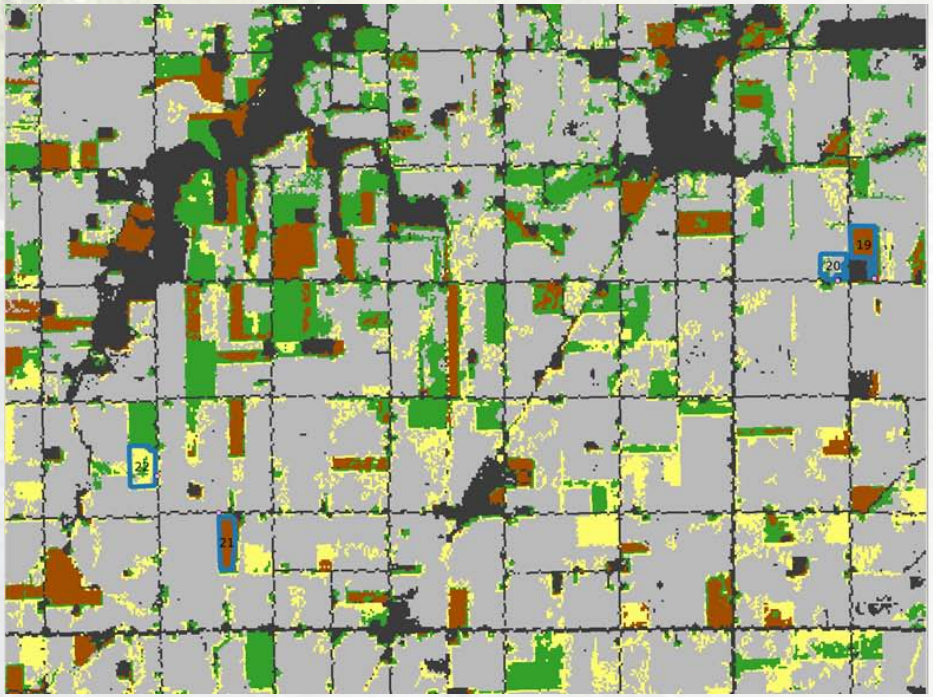
Estimate of crop residue cover
(Brown: 0%; Yellow: 40%; Green: 80%)



Field-level Tillage Practice
(Brown: CT; Yellow: RT; Green: NT)

Separating Covers from Grains

Winter cover crops maps are created with multiple satellite images from the fall, winter, and spring.



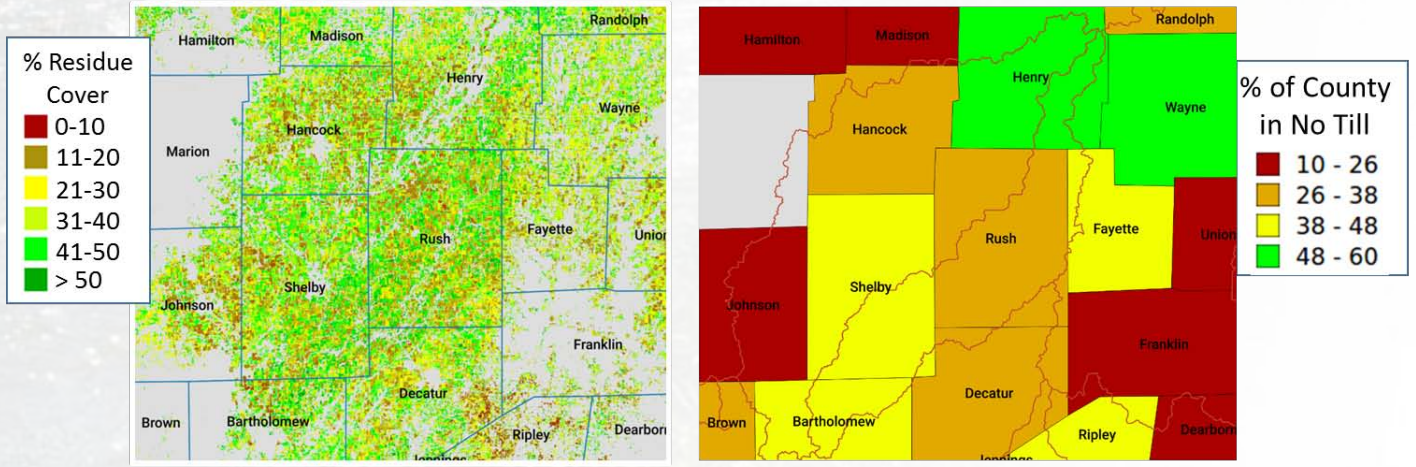
Winter-killed cover crops (yellow), cover crops that survive into the spring (green), and commodity cover crops that are harvested the following summer (brown). Grey areas do not have cover crops and black areas are non-agriculture or missing data. Landsat imagery from three time periods (26 December 2013, 11 April 2014, and 17 June 2014)

Producer Privacy

Maps are originally generated at a high level of detail (sub-farm field)…

…but, in many applications, it is not appropriate to release information at this scale

For these applications, estimates are summarized at the county and watershed scales



Results and Certainty

Accuracy estimates of the products generated in Indiana are based on over 10,000 observations from the tillage transect survey conducted in 2009, 2011, 2013, and 2015 in 7 pilot counties.

All products generated from OpTIS have an associated ***confidence level*** at the sub-farm field scale. Confidence is dependent on:

- **Number** of cloud-free satellite observations
- **Timing** of cloud-free satellite observations
- **Consistency** in the estimates from multiple satellite observations

Initial testing indicates high accuracy; typically explaining > 70% of the observed variation in residue cover. Full validation is under way now.

The Future of OpTIS

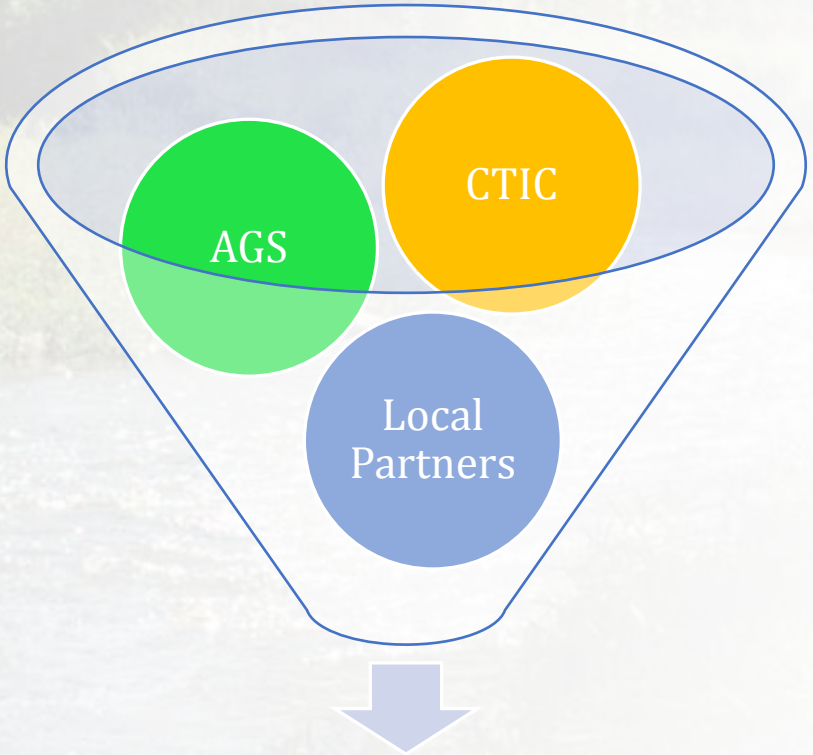
The desire is to see OpTIS used on cropland areas of the U.S.

- Data collected from all agricultural areas of the US

Data from 2004 – 2016 can be collected at a national scale to fill in the temporal gaps in existing tillage data in the CTIC database

Data can be scaled to National, State, County or Watershed scale

Partnership



Successful Implementation of OpTIS

How OpTIS relates to Water Quality Protection

Measuring the integration of conservation tillage into agriculture

Assessing the amount of continuous no-till taking place

Providing credible information for models that can help us estimate pollutant and sediment loads

- Can help us evaluate success in addressing threats to the Gulf of Mexico and Great Lakes from agriculture

Accurate way to measure adoption of cover crops

Information from OpTIS can help target outreach to areas that may need additional resources to encourage adoption of practices

For more information…

Chad Watts
(574) 242-0147
watts@ctic.org

www.ctic.org