Improving Water Quality and Soil Health through

Conservation Cropping Systems

Soil Health = Increased Productivity and Sustainability

Soil Health Management Systems / Conservation Cropping Systems

Soil Quality – a measure of the functional ability of soil to support optimal plant and animal productivity, and to regulate water flow and storage, and to provide an environmental buffer.

Soil Health: continued capacity of soil as a vital living system whereby plant and animal growth and environmental quality are sustained or regenerated; a holistic approach in which plant, animal, and human health are promoted

NRCS is a national leader in Soil Health!

- **What does *Soil Health* mean?**
- **Soil Health Key Indicators =**
  - Increas**ing** organic matter
  - Improv**ing** aggregate stability
  - Increas**ing** water infiltration
  - Increas**ing** water-holding capacity
  - Improv**ing** nutrient cycling
  - Enhanc**ing** and diversify**ing** soil biology

Soil Health is not a destination...it's a Journey

Soil Health Principles

Indiana is a national leader in Soil Health!

- **Achieving soil health through:**
  - **A <u>Quality</u> No-till (Never-Till) System**
  - **<u>Diverse</u> and <u>Strategic</u> Cover Crops**
  - **<u>Adapted</u> Nutrient Management**
  - **<u>Integrated</u> Weed & Pest Management**
  - **<u>Diverse</u> Crop Rotations**
  - **<u>Precision</u> Farming Technology**
  - **<u>Prescriptive</u> Buffers**

Soil Health is not a destination...it's a <u>Journey</u>

Conservation Cropping Systems

Incomplete System = sediment and nutrient loss

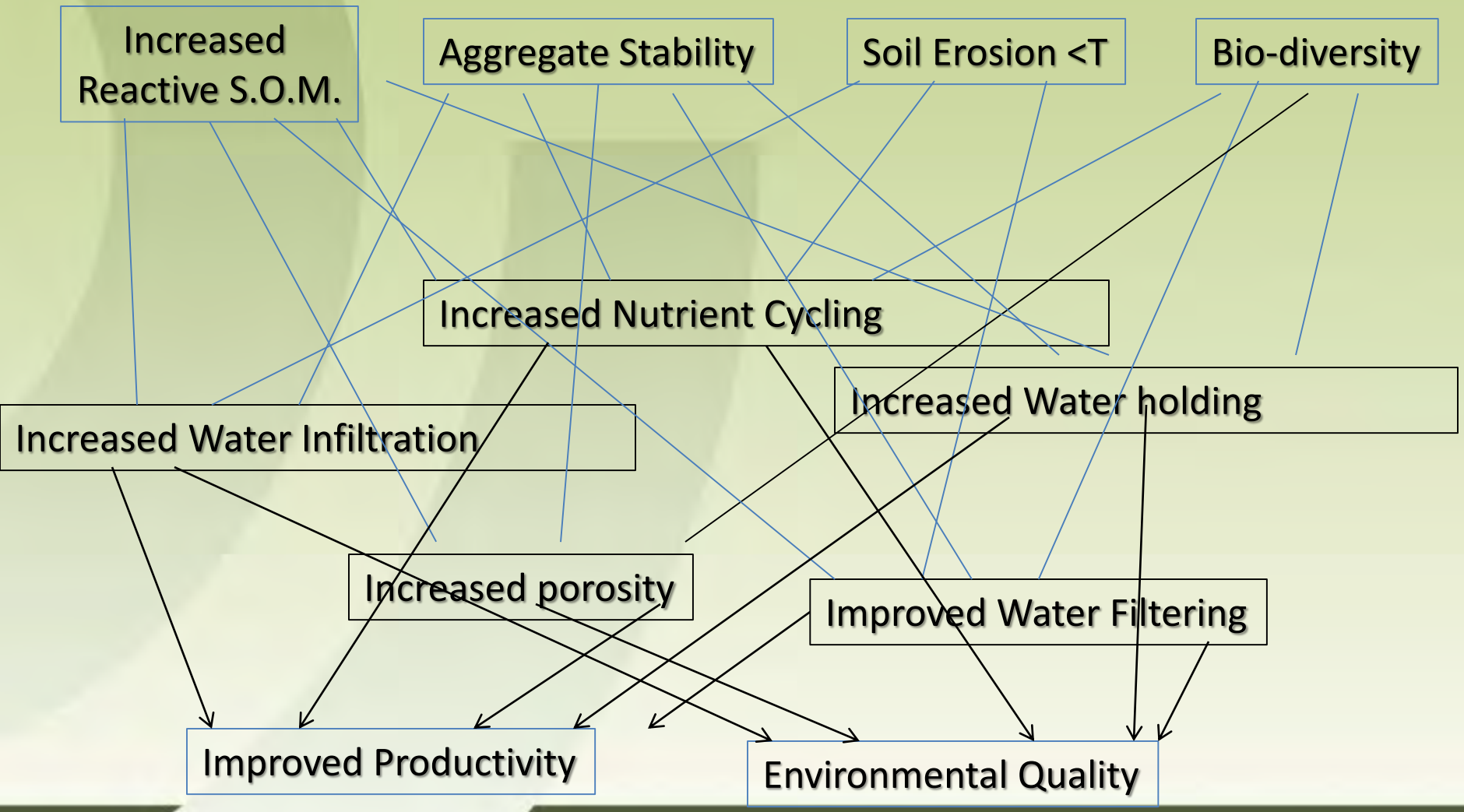
October, 2011

Lake Erie = sediment and algae plumes

SOLUTION = Conservation Cropping Systems

Water Quality

Soil Health:



Tile vs. Surface Water?

Mining Organic Matter Is Not An Option!

- **Each 1% of O.M. contains:**

10,000 lbs. of C/acre

1000 lbs. of N/acre

100 lbs. of P/acre

100 lbs. of S/acre

0.3”-1” (14,400 gallons) of H_2O/acre

Making Soil Health A Priority!

- **What does *Soil Health* mean?**
- **Soil Health Key Indicators =**
  - Increas**ing** water infiltration
  - Increas**ing** water-holding capacity

Synergistic Benefits of the System

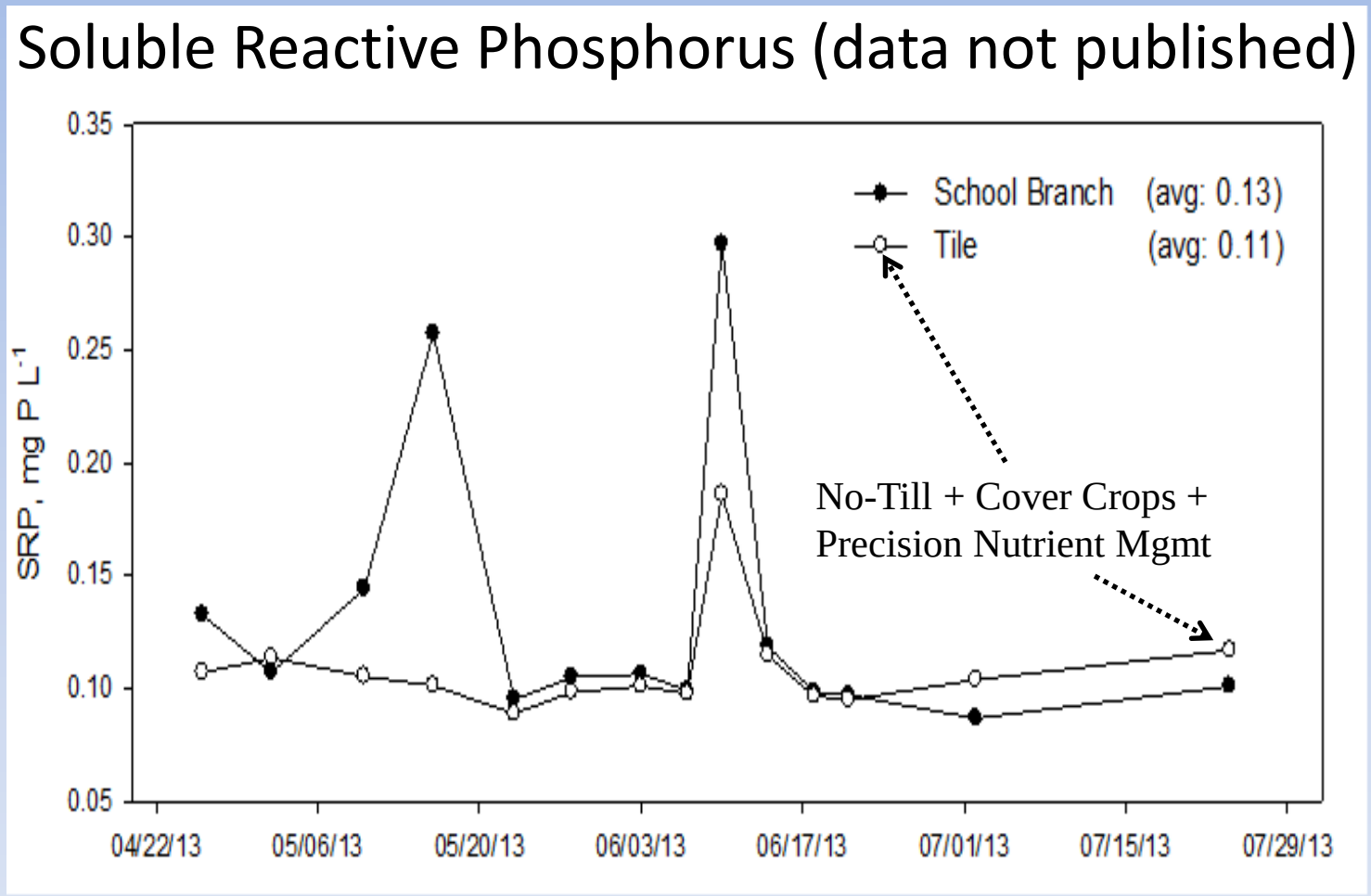
- **Nutrient management, no-till, crop rotation and cover crops were implemented as a SYSTEM!**
- **Annual nitrate concentrations in tile water dropped from over 30 mg/l to under 10 mg/l**

- Dr. Eileen Kladivko
Purdue University

Eagle Creek Watershed Monitoring

(Indiana University - Purdue University Indianapolis)

Soluble Reactive Phosphorus (data not published)

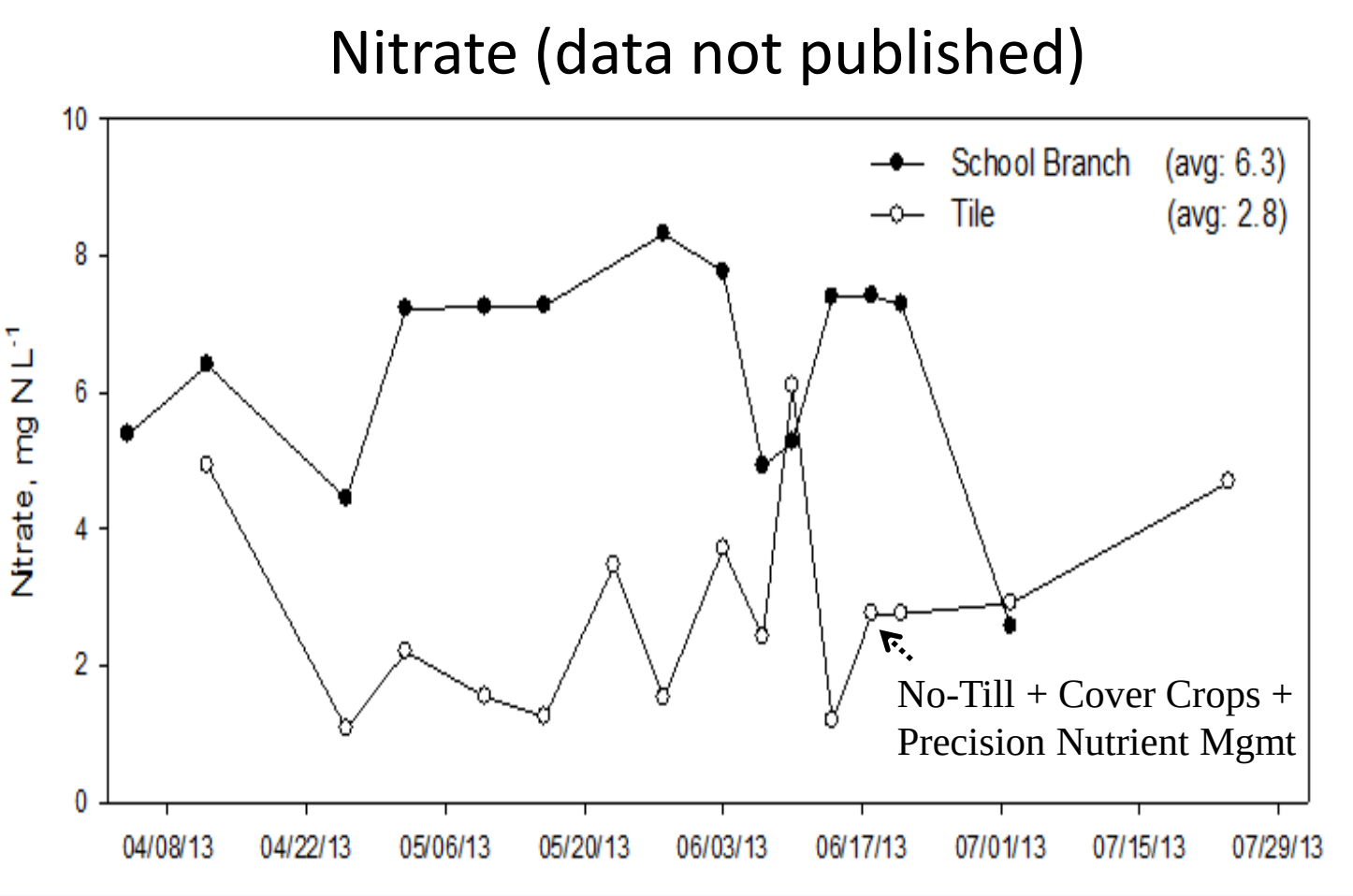


Rainfall: May 15-17 (0.5 inch), June 9-10 (0.7 inch)

PA Jacinthe

Eagle Creek Watershed Monitoring

(Indiana University - Purdue University Indianapolis)



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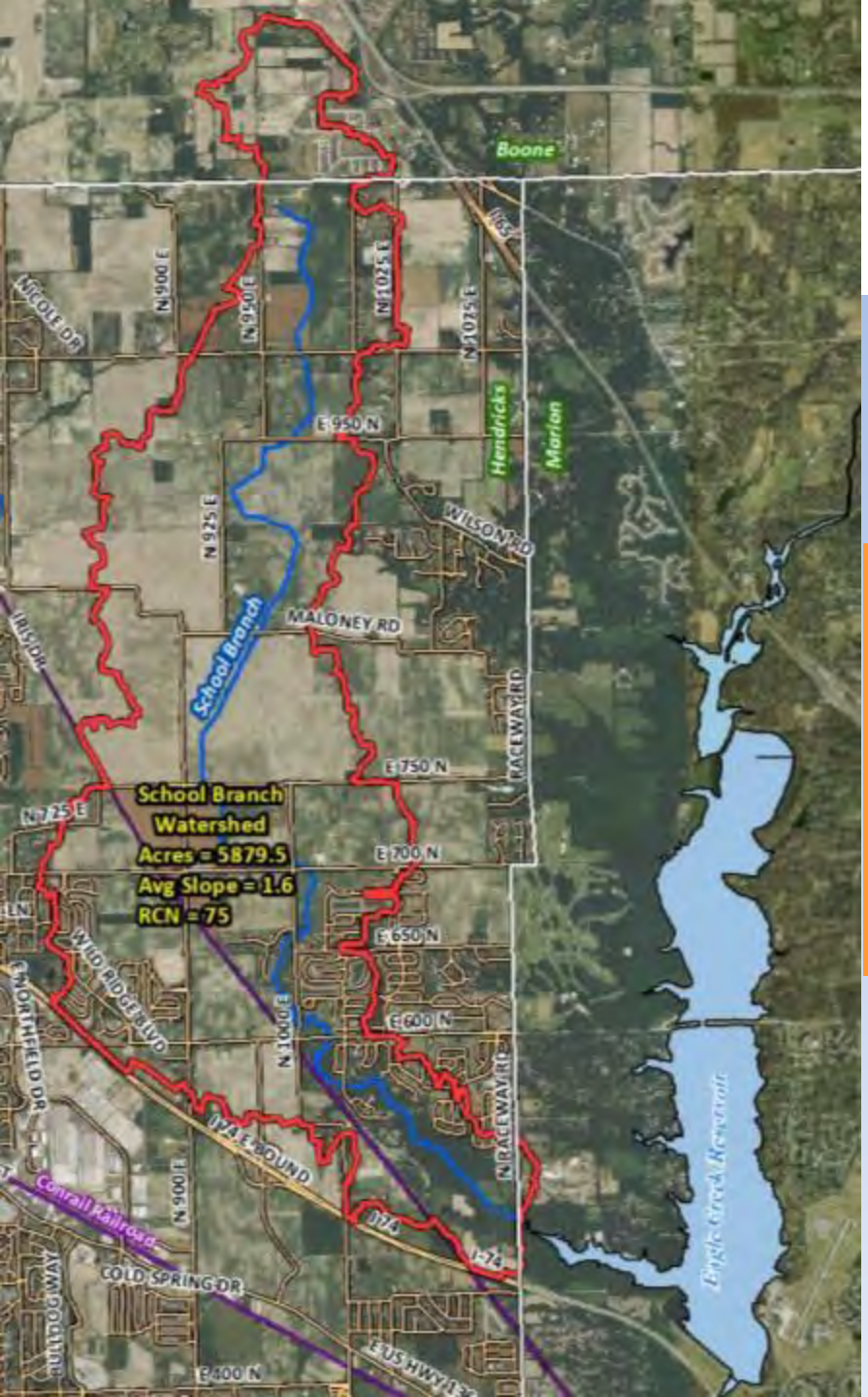
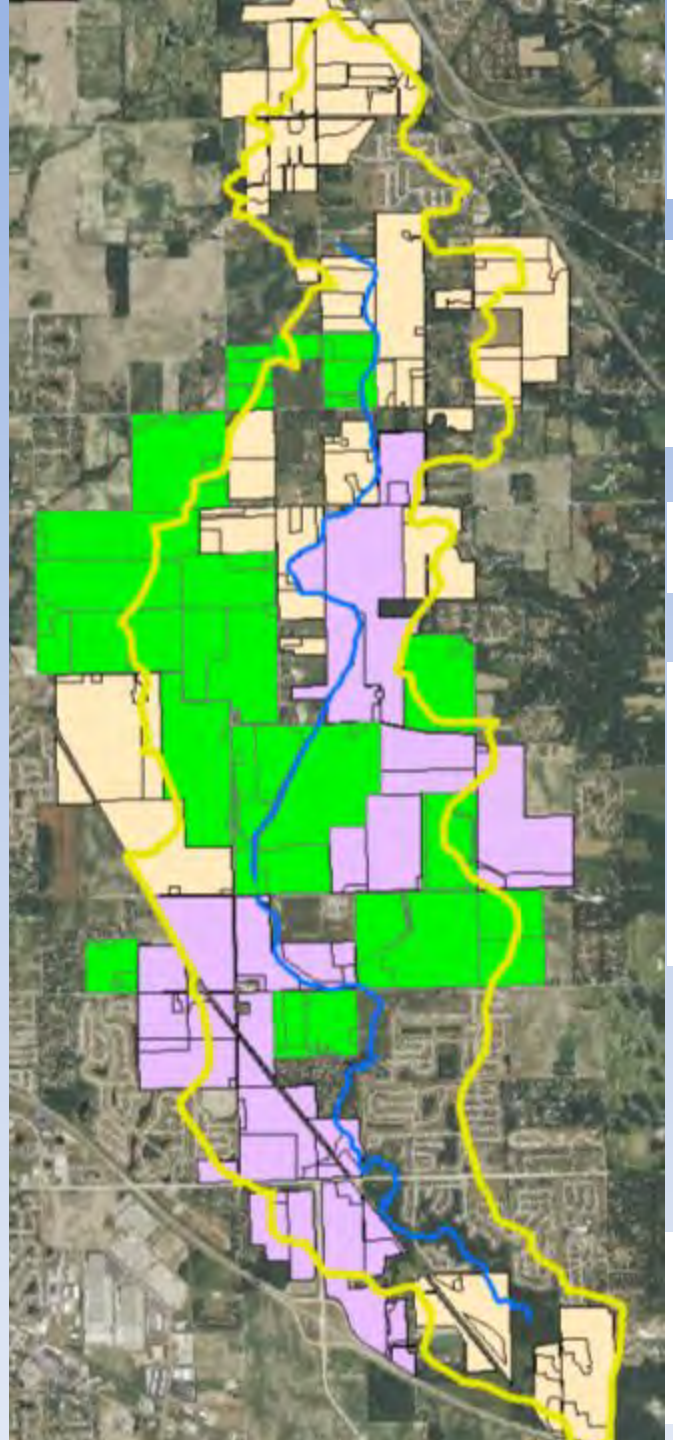


School Branch (Indiana) Monitoring Project

<u>Objective</u>:

Document the potential for production agriculture to complement water resources through the implementation of soil health management systems



School Branch (Indiana)Monitoring Project

Targeted Efforts =

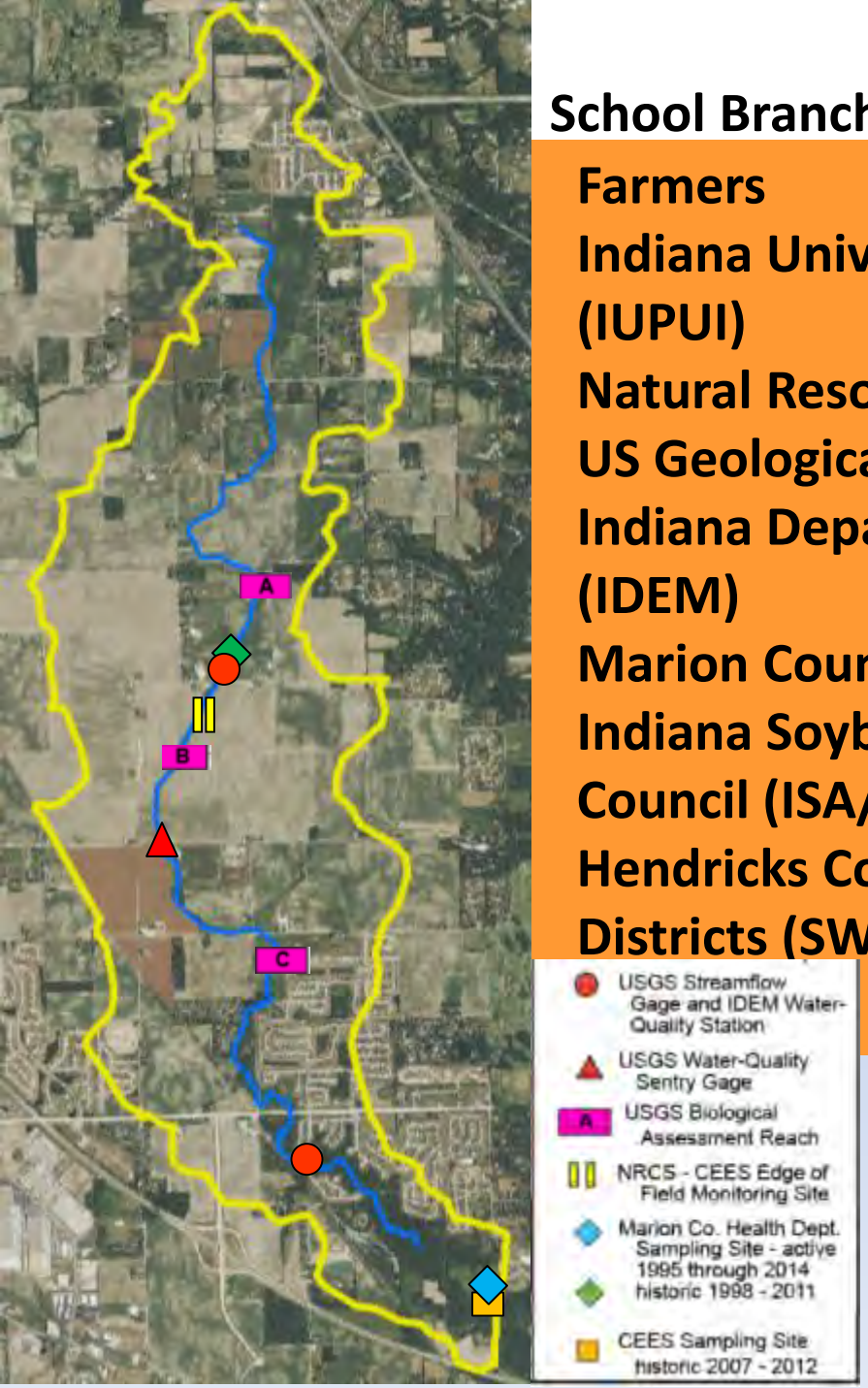
NRCS National Water Quality Initiative (NWQI)

Field to Market - Field Print Calculator

80% Agriculture

Over 40% in soil health management systems

- **continuous no-till +**
- **cover crops +**
- **intense nutrient management**



School Branch (Indiana) Monitoring Project Partners

Farmers

Indiana University - Purdue University Indianapolis (IUPUI)

Natural Resources Conservation Service (NRCS)

US Geological Survey (USGS)

Indiana Department of Environmental Management (IDEM)

Marion County Health Department (MHCD)

Indiana Soybean Alliance/Indiana Corn Marketing Council (ISA/ICMC)

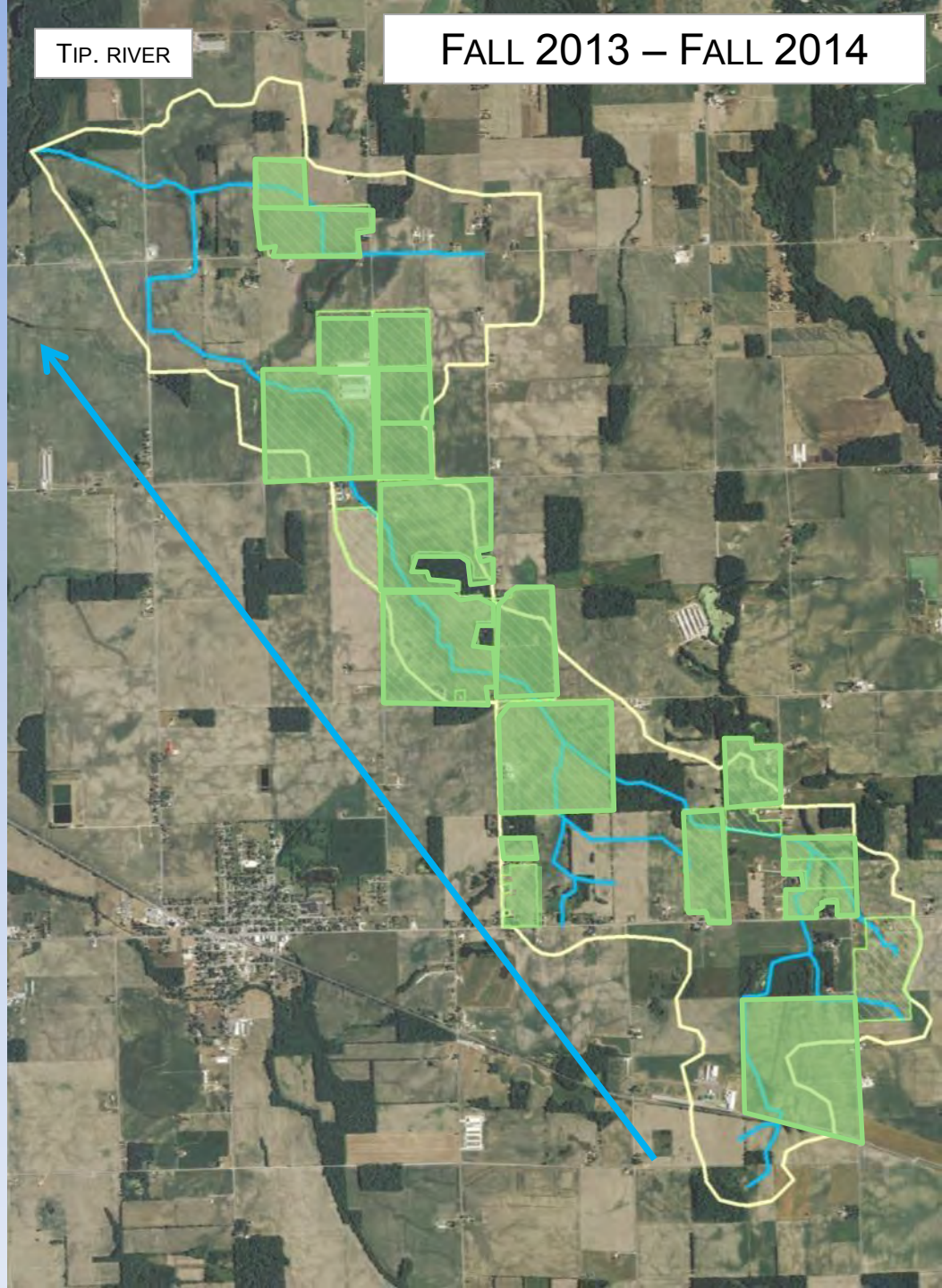
Hendricks County Soil and Water Conservation Districts (SWCD)

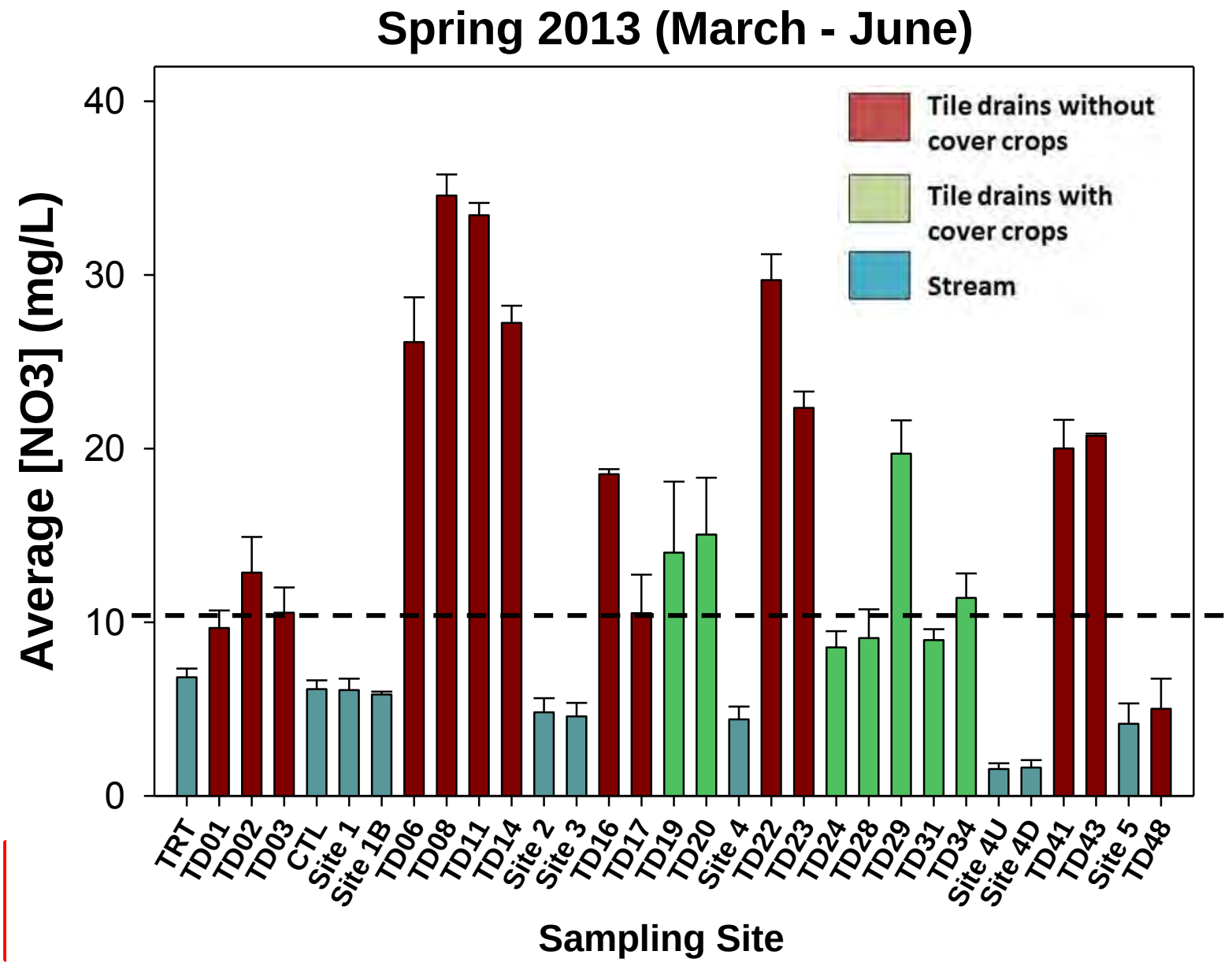
- **Indiana Geological Survey (IGS)**

SHATTO DITCH (INDIANA) MONITORING

NOTRE DAME

- During our pre-treatment year, **only 320.6 acres** were planted in cover crop
- Cover crop acreage **increased to 1,610.1 acres** in Fall 2013
- Represents **49%** of the Shatto Ditch Watershed





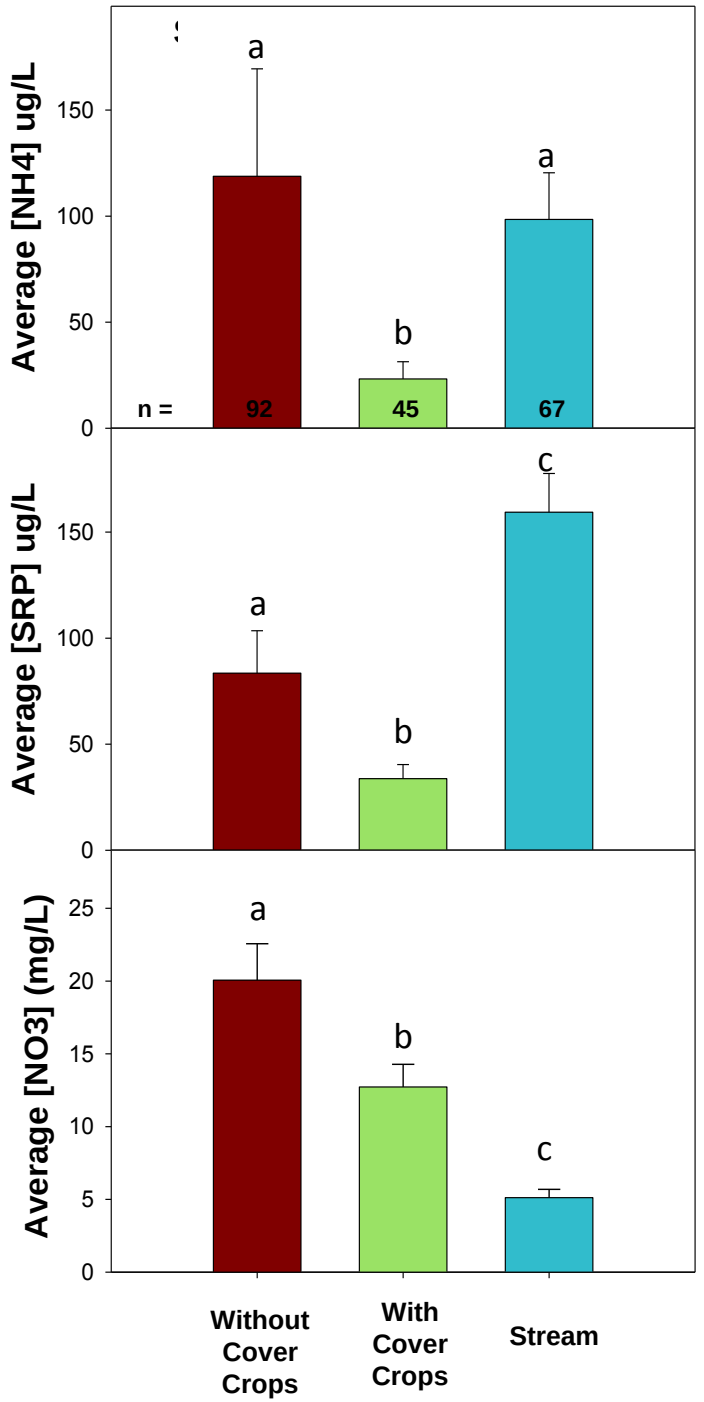
Hanrahan and Tank, unpublished data. University of Notre Dame.

Pre-Treatment Year: Comparing nutrients leaving fields with cover crops to fields without cover crops

- Tile drains from fields with cover crops export less NH_4^+, SRP and NO_3^-.

Future Analysis:

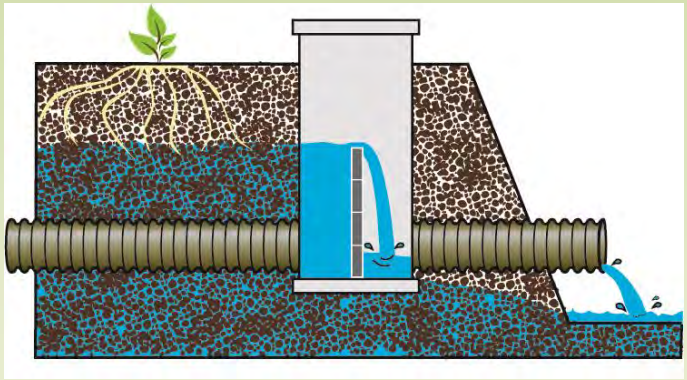
- Analyzing data in light of "key" times during the year to put our work in context
  - Fall harvest, winter bare fallow, spring cover crop growth, and post cover crop

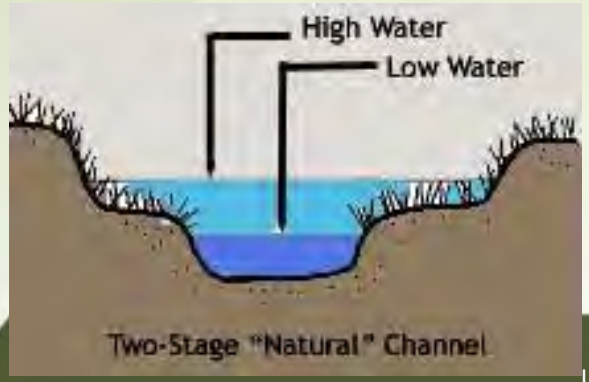


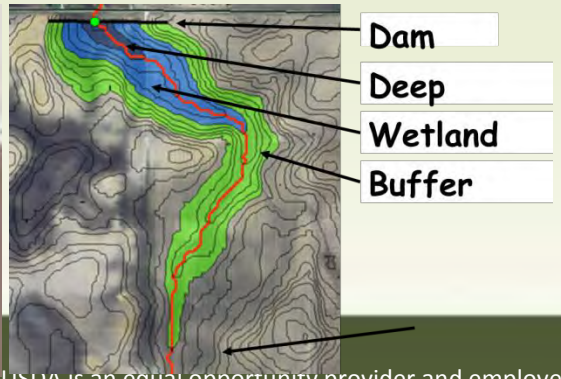
Hanrahan and Tank, unpublished data. University of Notre Dame.

Innovative Technologies

- Blind Inlets
- Drainage Water Management
- Denitrifying Bioreactors
- 2-stage Ditch
- Constructed Wetlands

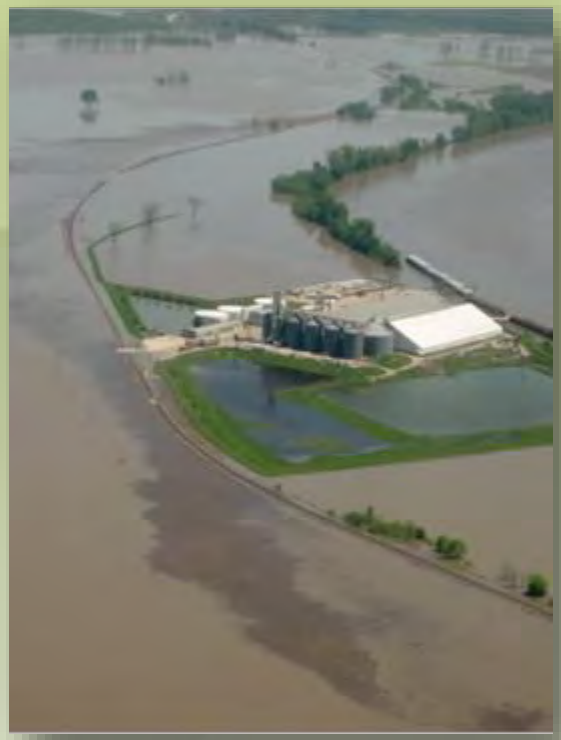




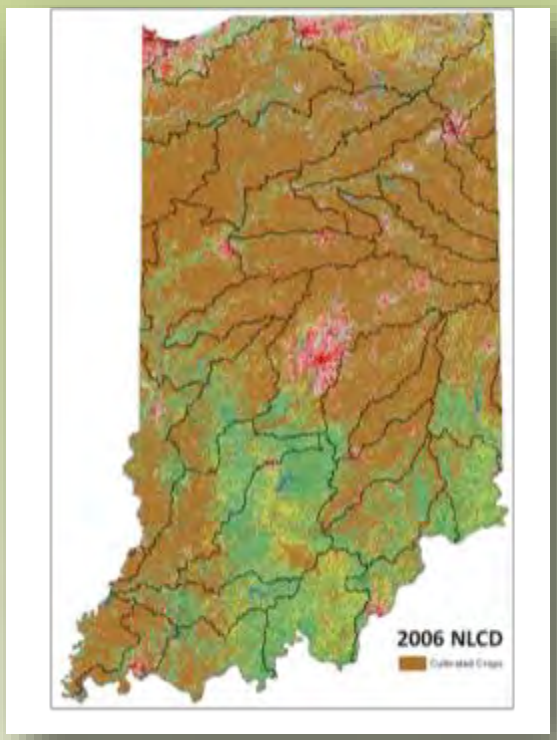


Conservation Cropping Systems

Incomplete System = more runoff & less water-holding capacity



Mississippi River Watershed Flood 2011 = flood damage, sediment and nutrients

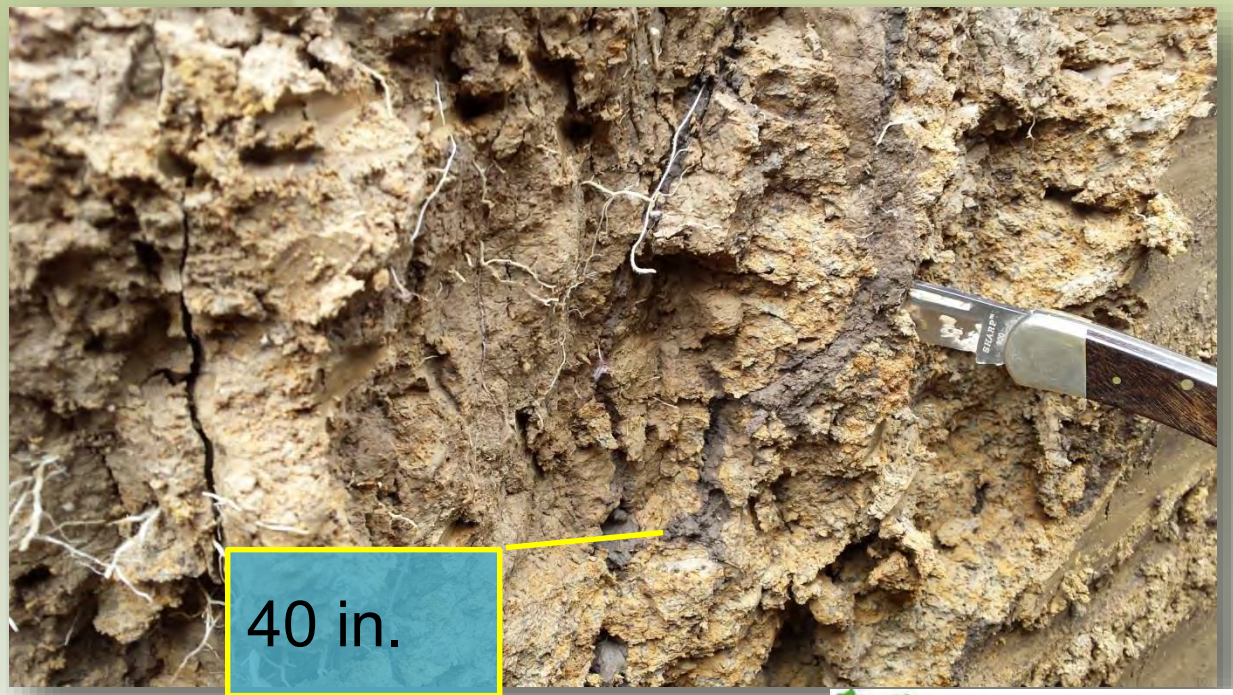


SOLUTION = Conservation Cropping Systems on a watershed scale

Water Quantity

Taking the Soil Health Journey

- What does *Soil Health* mean?
- Soil Health Key Indicators =
  - Increasing organic matter
    - What kind
    - Where



What's in 1% organic matter?

Water Holding Capacity

Organic Carbon Percent	Water Per Acre (Gallons)
1%	14,400 (54,5000L)
2%	28,800
3%	43,200
4%	57,600
5%	80,000
8%	128,000

Water Quantity/Flooding
A landscape example…

By **increasing the water absorption** of all of the cropland in the Mississippi River Basin by just **one-half inch** (through improved soil health), that water retention would be the equivalent of…

A landscape example…

- The amount of water that flows over Niagara Falls in 83 days!!!

Conservation Cropping Systems

Incomplete System = particulate matter and emissions

Lubbock, Texas 2011 = particulate matter

SOLUTION = Conservation Cropping Systems

Air Quality

Conservation Cropping Systems

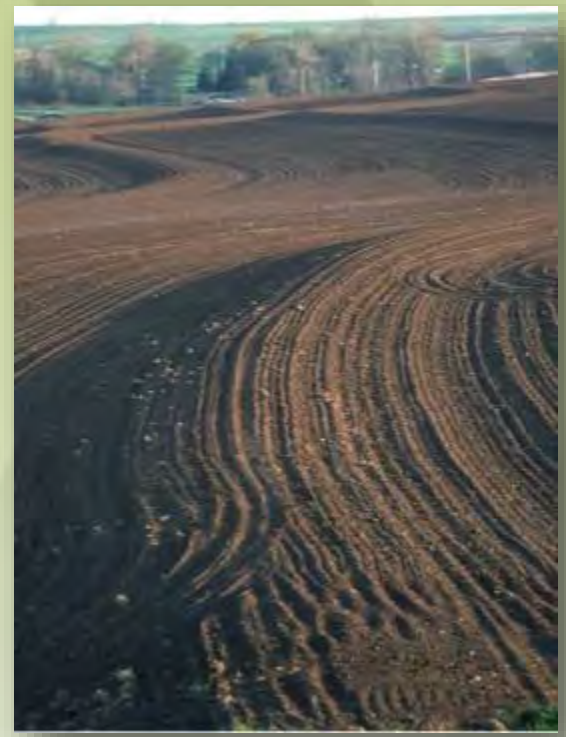
Incomplete System = multiple tillage passes = fuel

Worldwide Energy Demand

SOLUTION = Conservation Cropping Systems

Energy

Conservation Cropping Systems



Incomplete System = no cover, minimal biology

Healthy Soil Biota
Pollinators

SOLUTION = Conservation Cropping Systems

Wildlife

Conservation Cropping Systems

Virginia

System

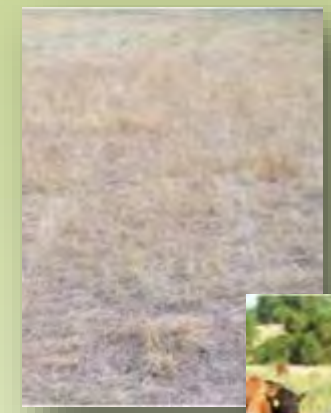
Incomplete System

Indiana

System

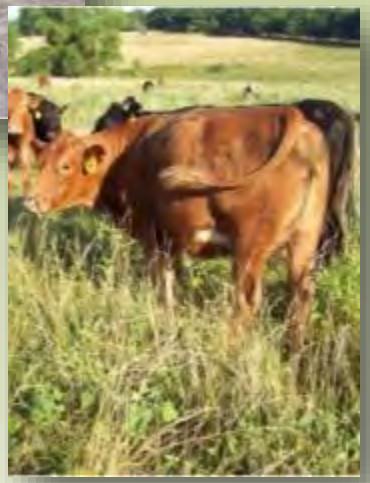
Incomplete System

Missouri



Unmanaged Pasture

Managed Pasture System

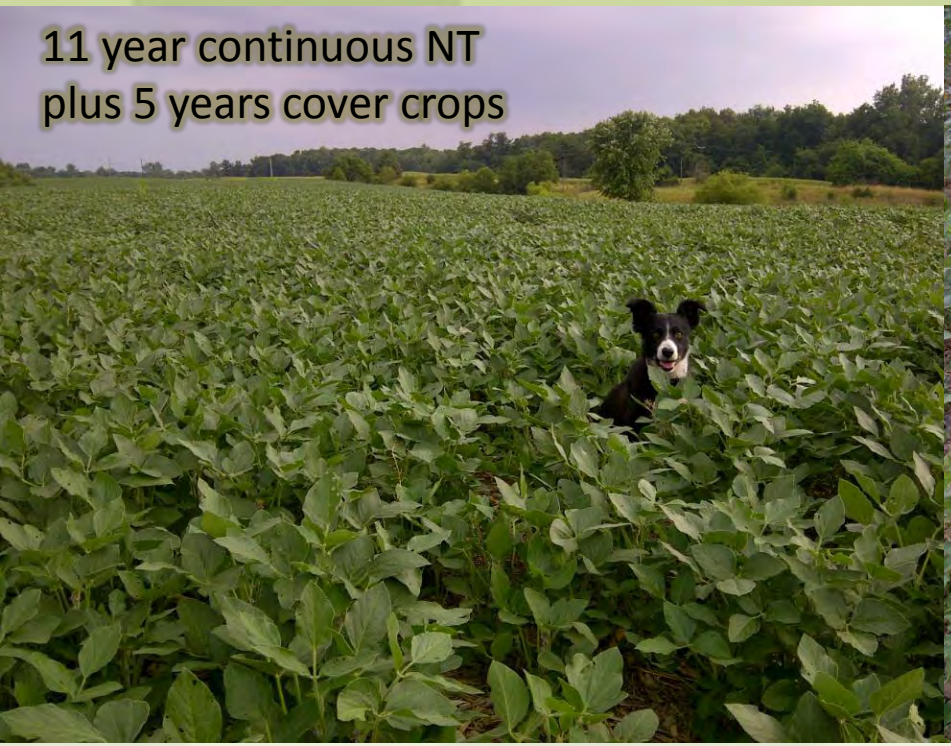


Stable, Sustainable Food Supply

Risk Reduction

"Insurance" against drought, floods, markets

“Insurance”
July 8, 2012 4:30 p.m.



Conservation Cropping Systems

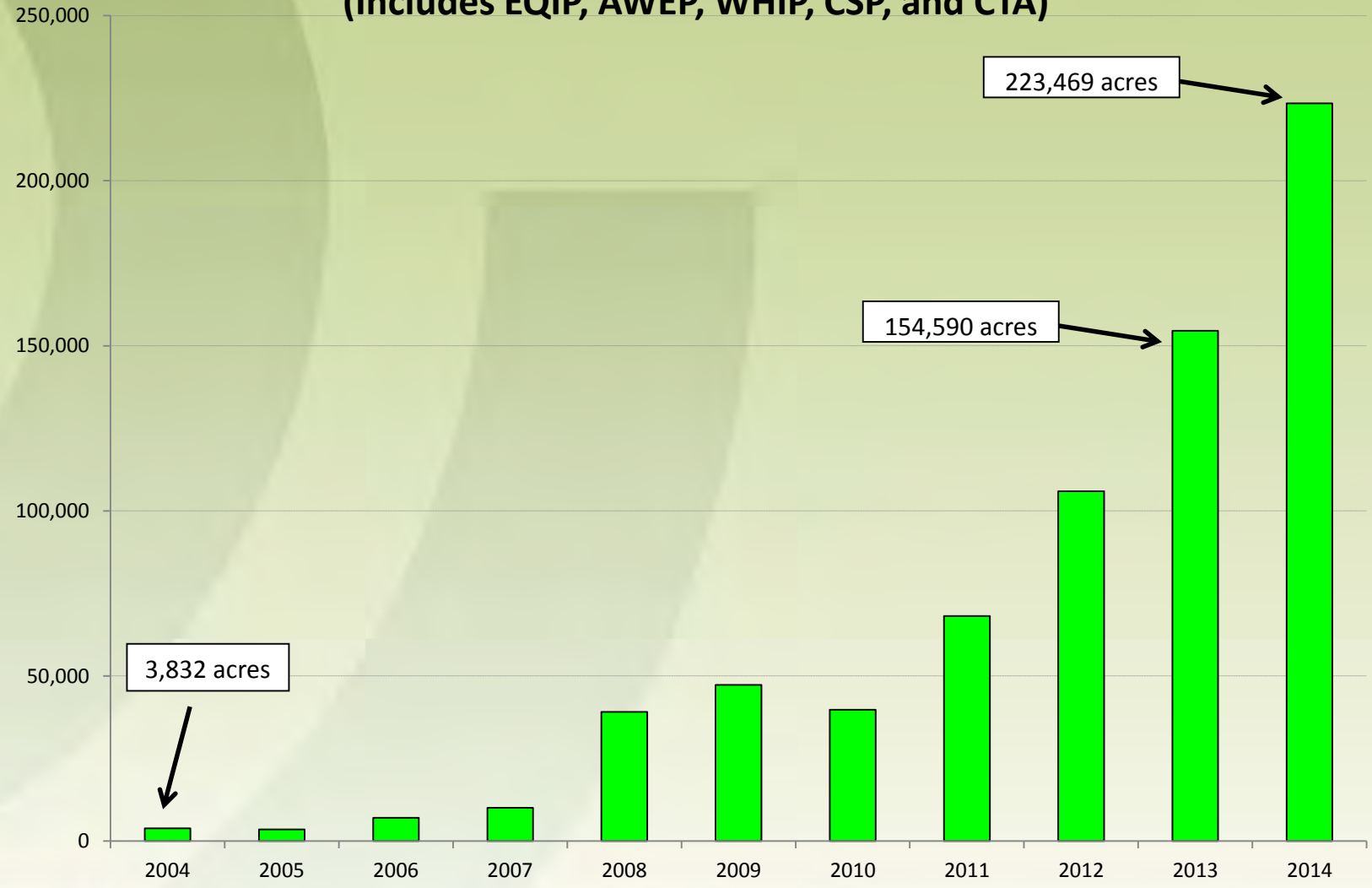
Incomplete System = Higher likelihood for environmental concerns

Gully Erosion Repair

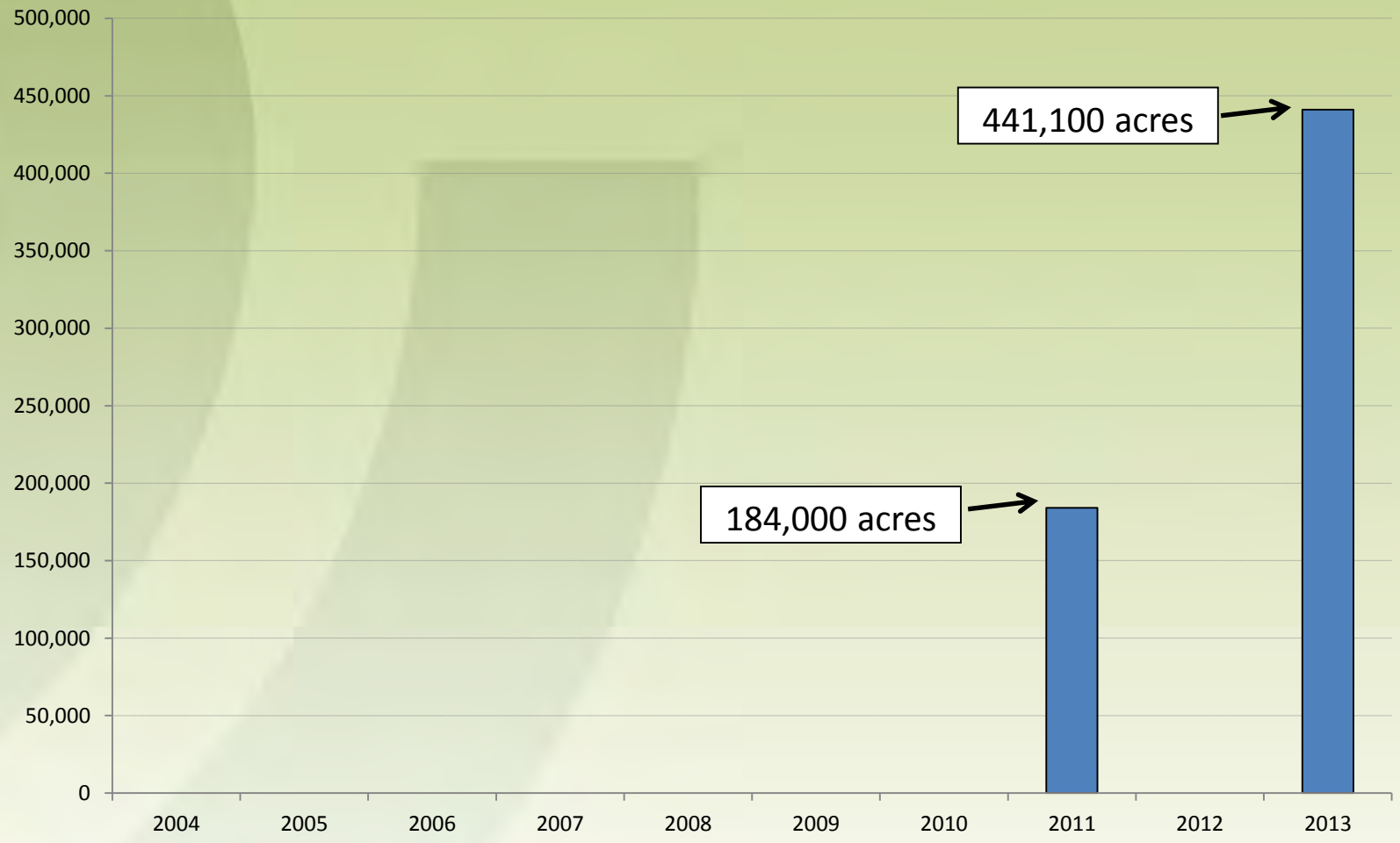
SOLUTION = Conservation Cropping Systems

Public Cost Savings

INDIANA PRS-REPORTED APPLIED COVER CROP ACRES
(Includes EQIP, AWEP, WHIP, CSP, and CTA)

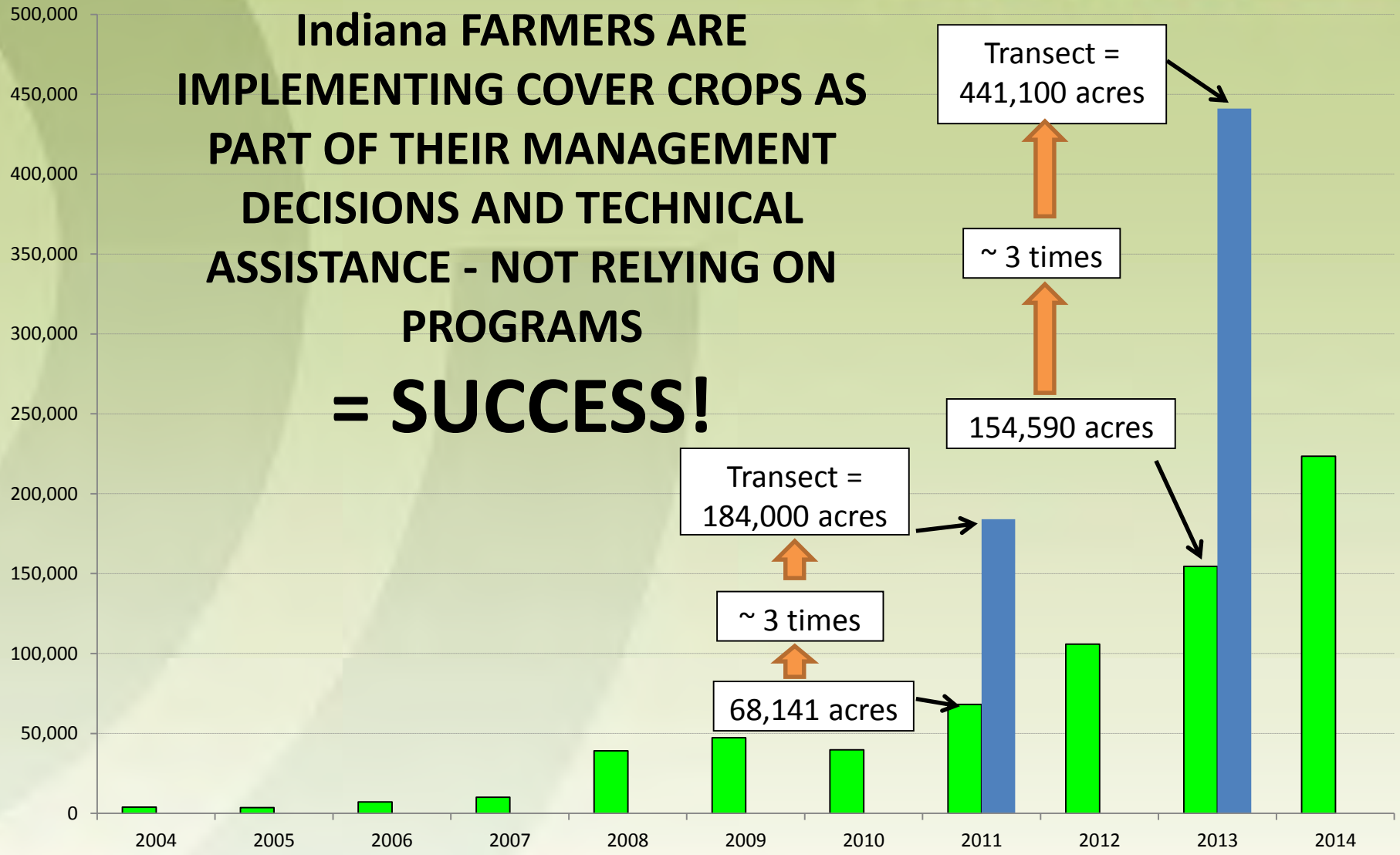


INDIANA TILLAGE TRANSECT COVER CROP ACRES
NRCS Customers and Others



Indiana FARMERS ARE IMPLEMENTING COVER CROPS AS PART OF THEIR MANAGEMENT DECISIONS AND TECHNICAL ASSISTANCE - NOT RELYING ON PROGRAMS

= SUCCESS!



MORE INFORMATION ABOUT SOIL HEALTH -

http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/soils/health/

Questions?

For More Information:
www.in.nrcs.usda.gov