

US EPA ARCHIVE DOCUMENT



# 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 =**
  - Increasinging organic matter
  - Improving aggregate stability
  - Increasinging water infiltration
  - Increasinging water-holding capacity
  - Improving nutrient cycling
  - Enhancing and diversifying 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 Quality No-till (Never-Till) System
  - Diverse and Strategic Cover Crops
  - Adapted Nutrient Management
  - Integrated Weed & Pest Management
  - Diverse Crop Rotations
  - Precision Farming Technology
  - Prescriptive Buffers



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



# Conservation Cropping Systems



**Incomplete System =  
sediment and nutrient  
loss**



**Lake Erie = sediment  
and algae plumes**

October, 2011

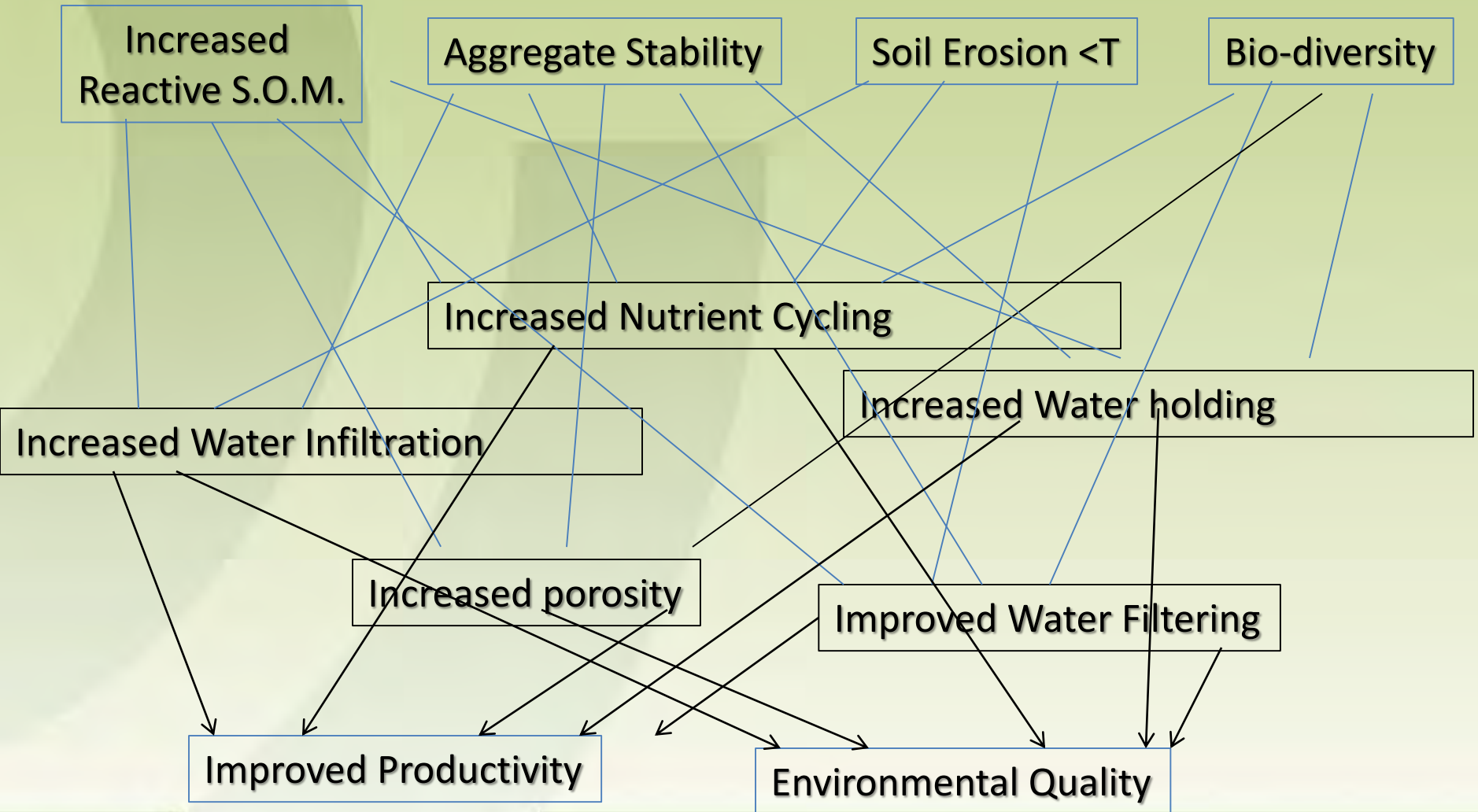


**SOLUTION = Conservation  
Cropping Systems**

## 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<sub>2</sub>O/acre**



# Making Soil Health A Priority!

- What does *Soil Health* mean?
- **Soil Health Key Indicators =**
  - Increasing water infiltration
  - Increasing 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

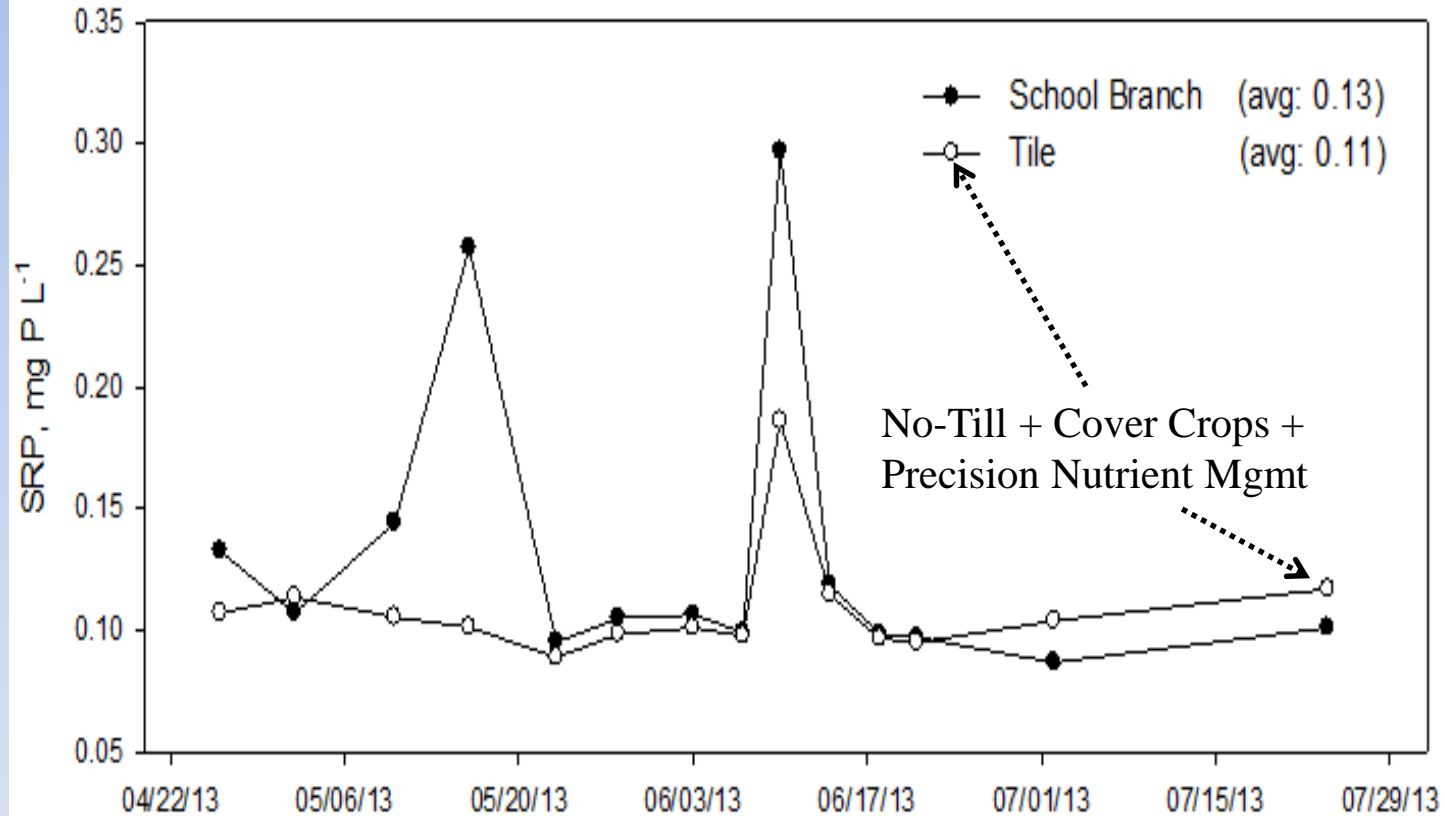


*- Dr. Eileen Kladivko  
Purdue University*

# Eagle Creek Watershed Monitoring

(Indiana University - Purdue University Indianapolis)

## Soluble Reactive Phosphorus (data not published)

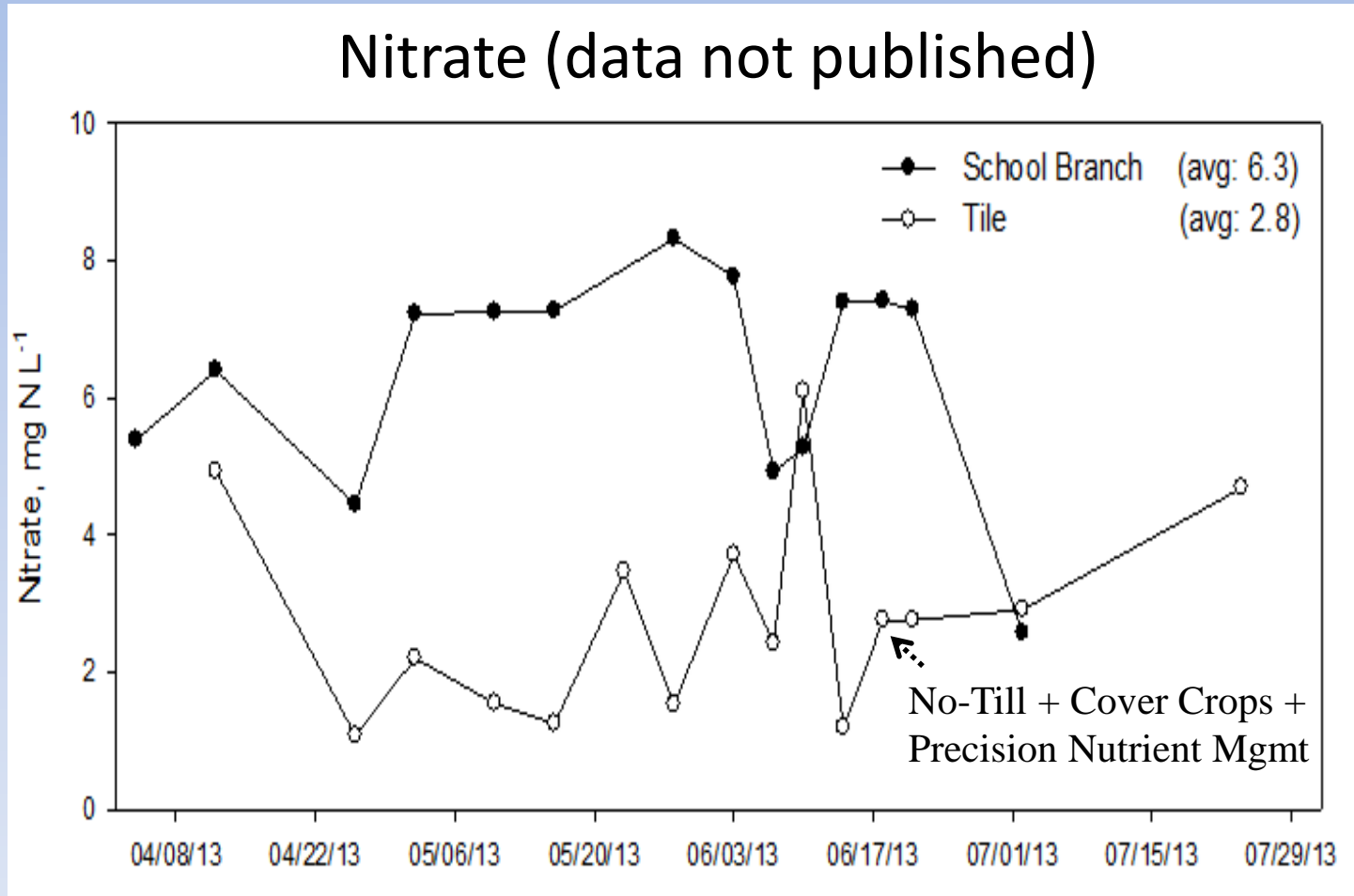


Rainfall: May 15-17 (0.5 inch), June 9-10 (0.7 inch)

PA Jacinthe

# Eagle Creek Watershed Monitoring

(Indiana University - Purdue University Indianapolis )



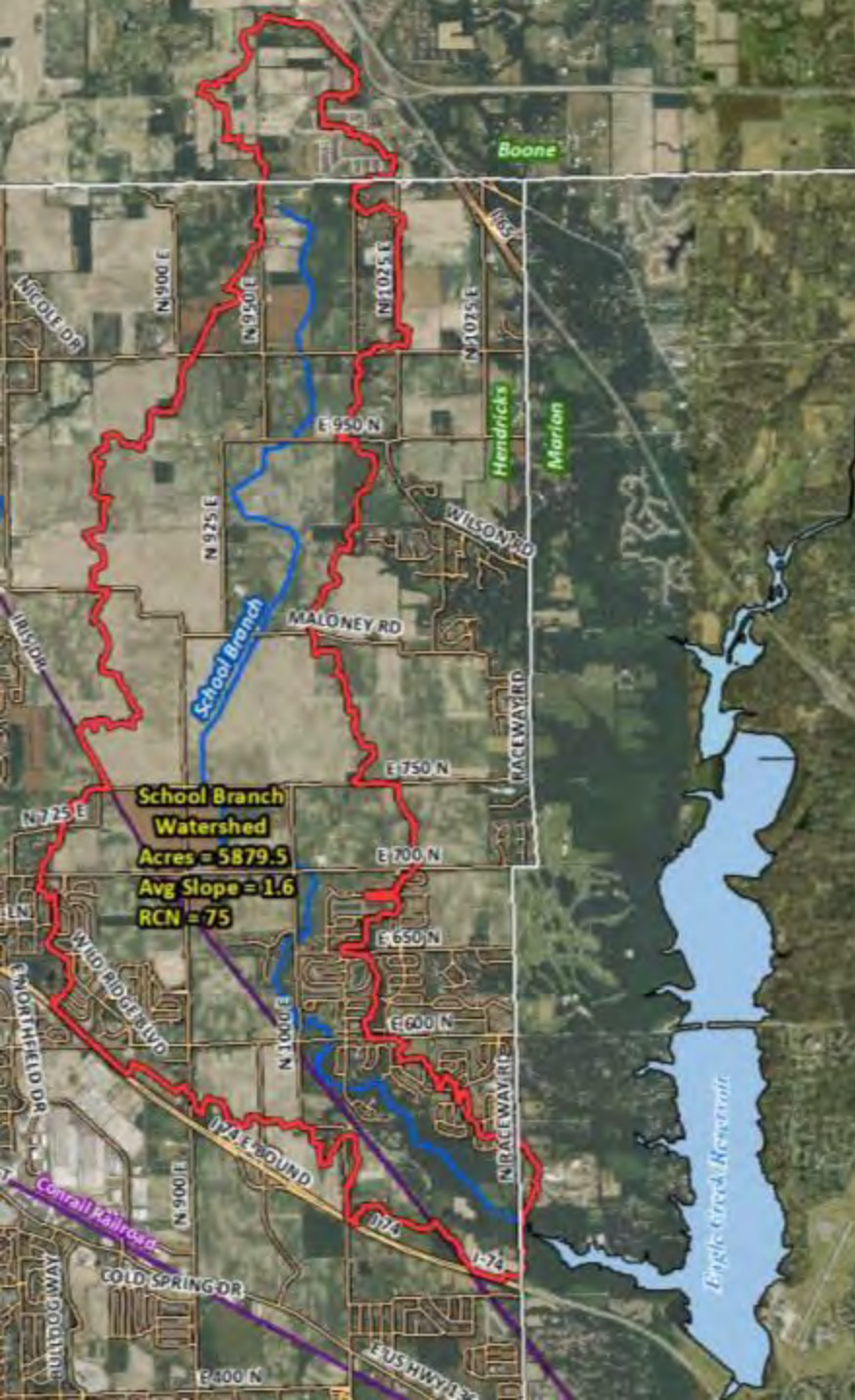
Rainfall: May 15-17 (0.5 inch), June 9-10 (0.7 inch)

PA Jacinthe

# School Branch (Indiana) Monitoring Project

## Objective:

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





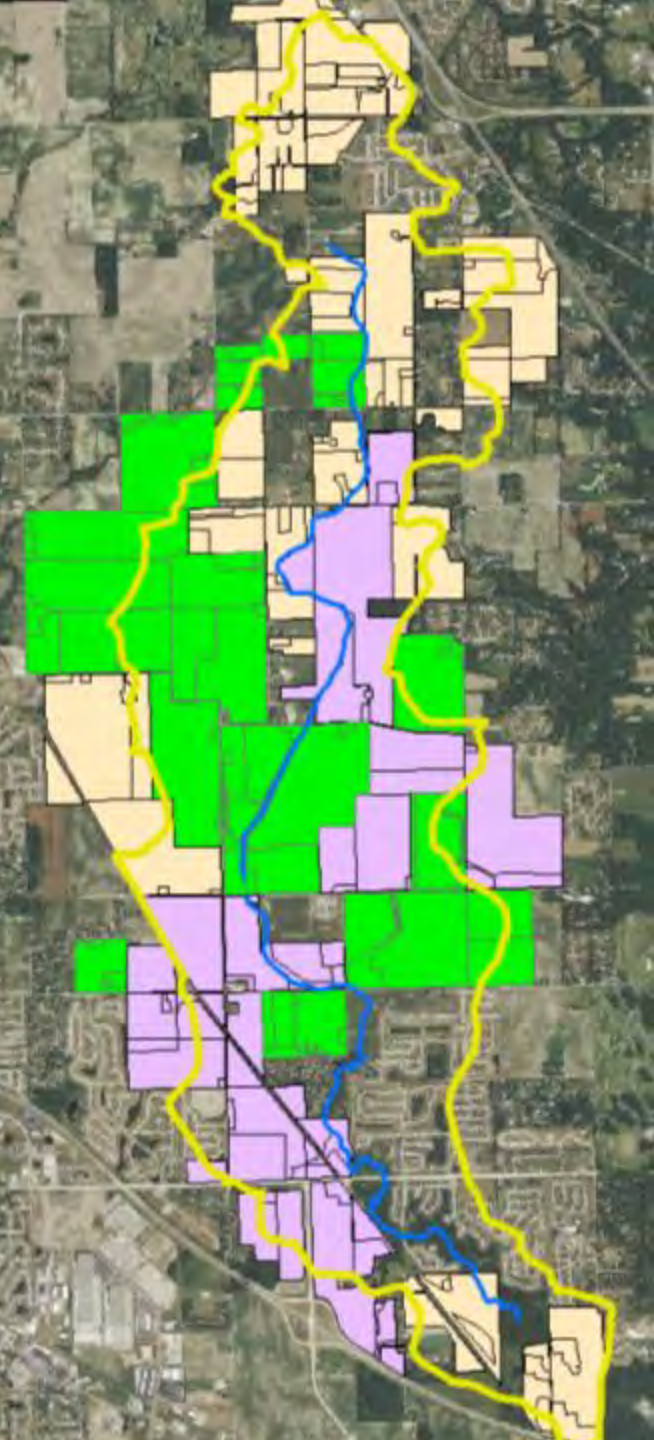
# School Branch (Indiana) Monitoring Project

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



Typical Tillage Management  
Strip-Tillage  
No-Till + Cover Crops

# School Branch (Indiana) Monitoring Project Partners

Farmers

Indiana University - Purdue University Indianapolis (IUPUI)

Natural Resources Conservation Service (NRCS)

US Geological Survey (USGS)

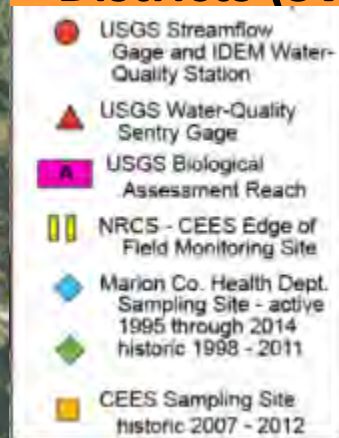
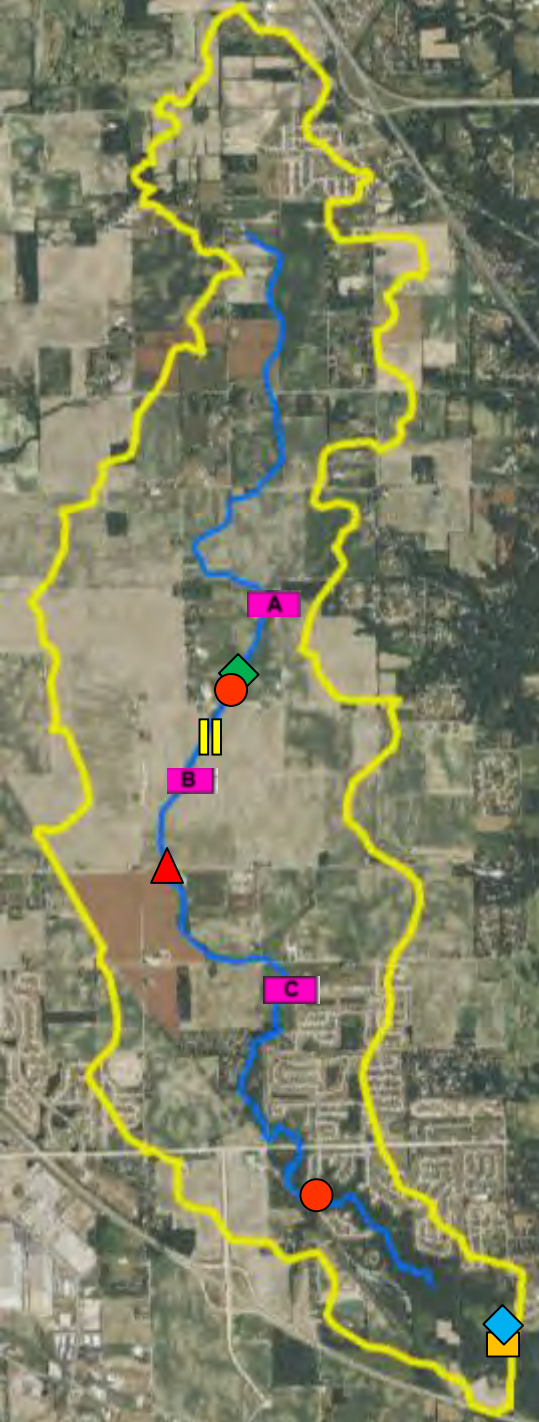
Indiana Department of Environmental Management (IDEM)

Marion County Health Department (MHCD)

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

Hendricks County Soil and Water Conservation Districts (SWCD)

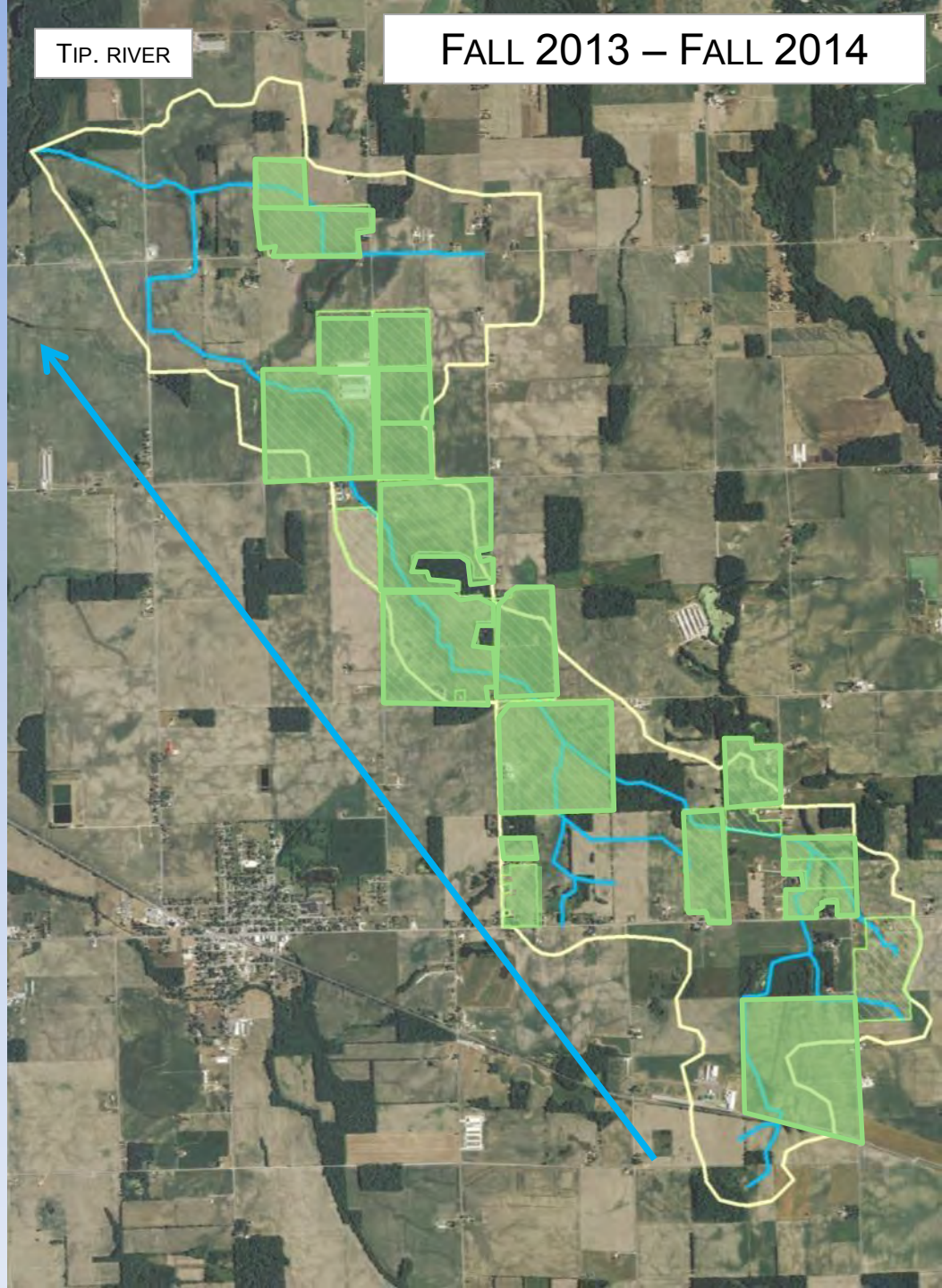
- Indiana Geological Survey (IGS)



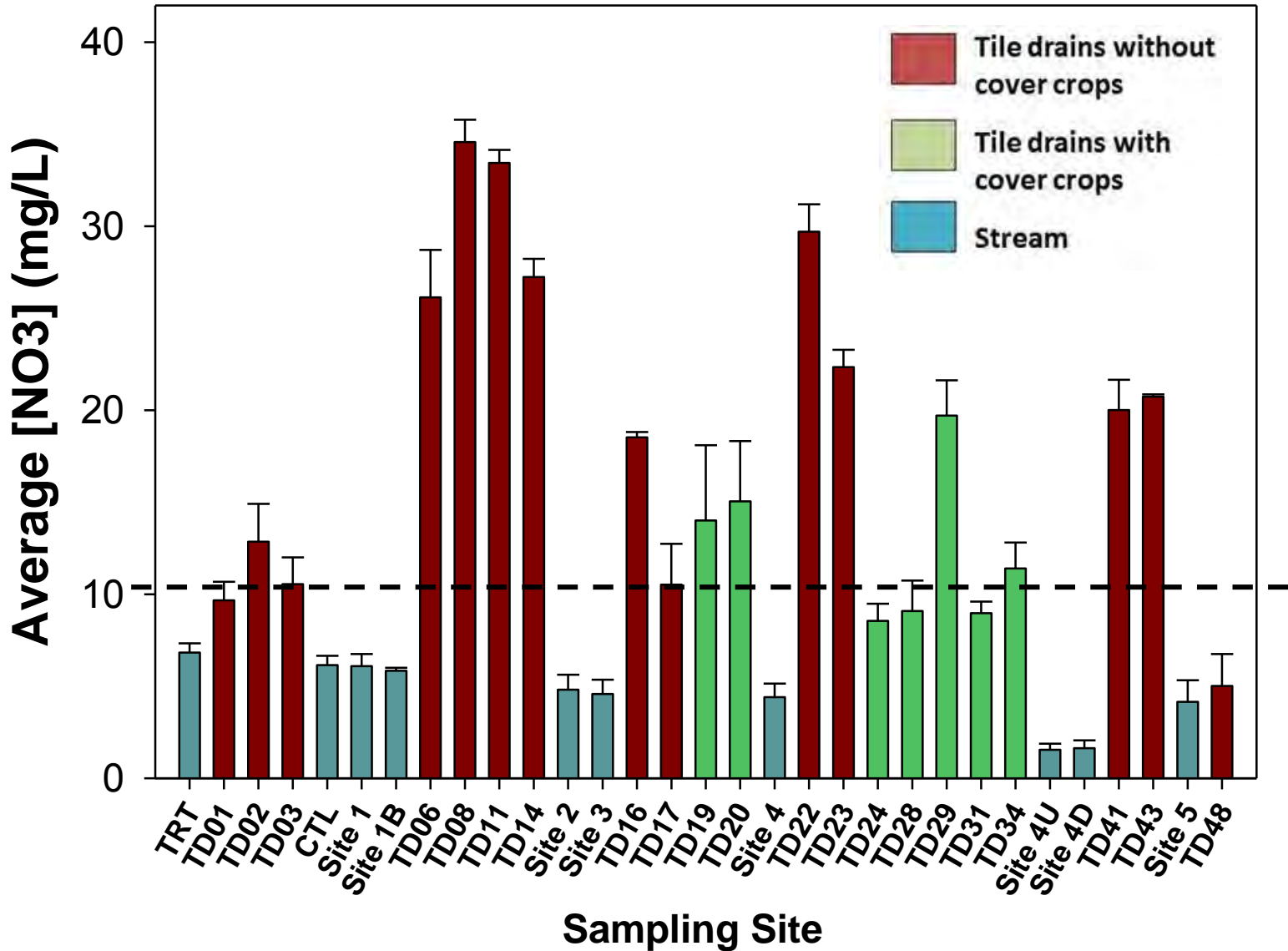
# SHATTO DITCH (INDIANA) MONITORING

## 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



# Spring 2013 (March - June)

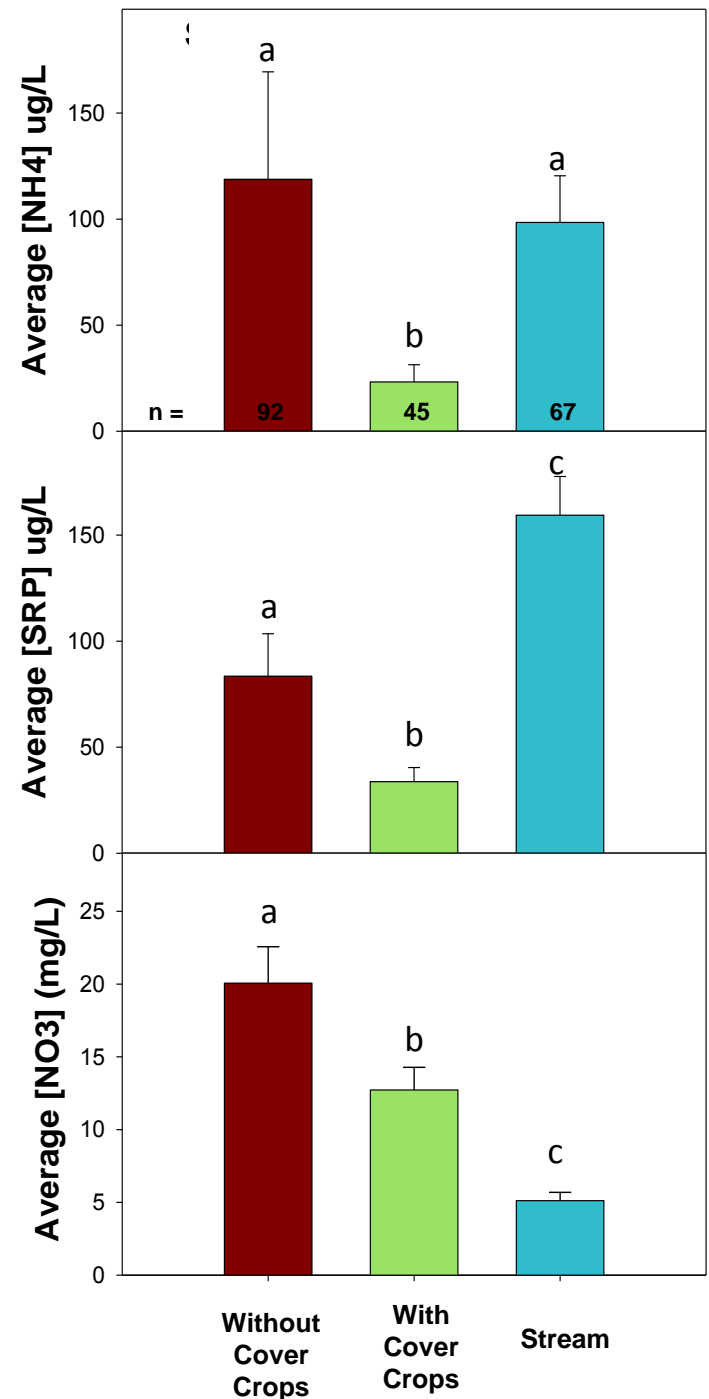


# PRE-TREATMENT YEAR: COMPARING NUTRIENTS LEAVING FIELDS WITH COVER CROPS TO FIELDS WITHOUT COVER CROPS

- Tile drains from fields with cover crops export less  $\text{NH}_4^+$ , SRP and  $\text{NO}_3^-$ .

## Future Analysis:

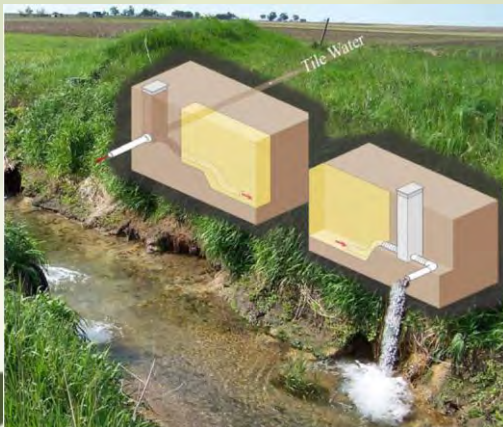
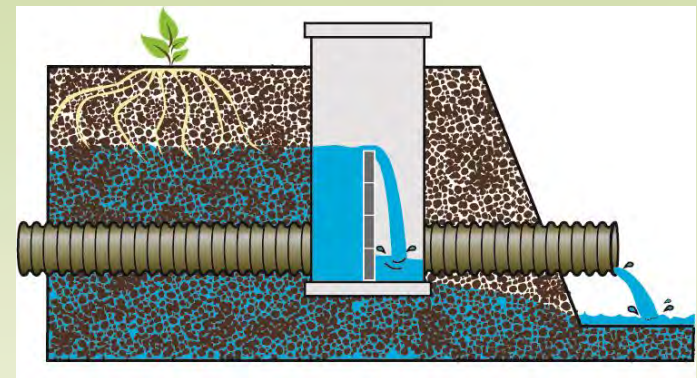
- Analyzing data in light of “key” times during the year to put our work in context
  - Fall harvest, winter bare fallow, spring cover crop growth, and post cover crop



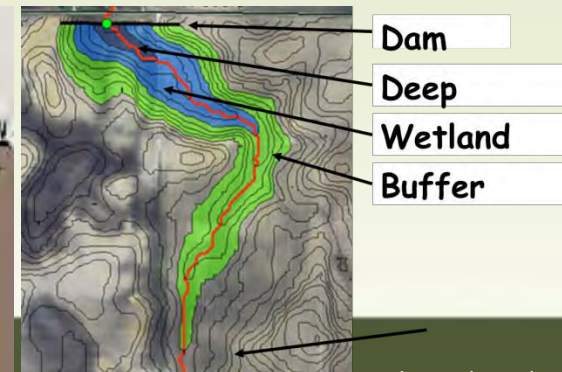
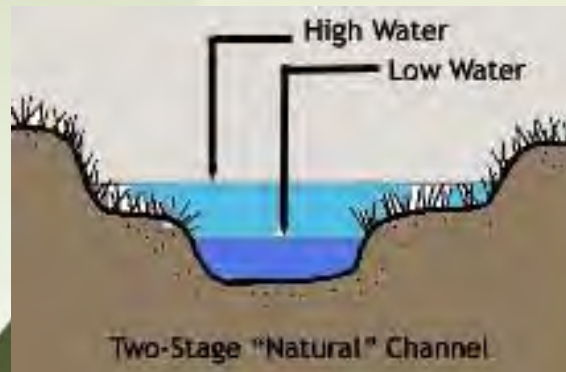


# Innovative Technologies

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



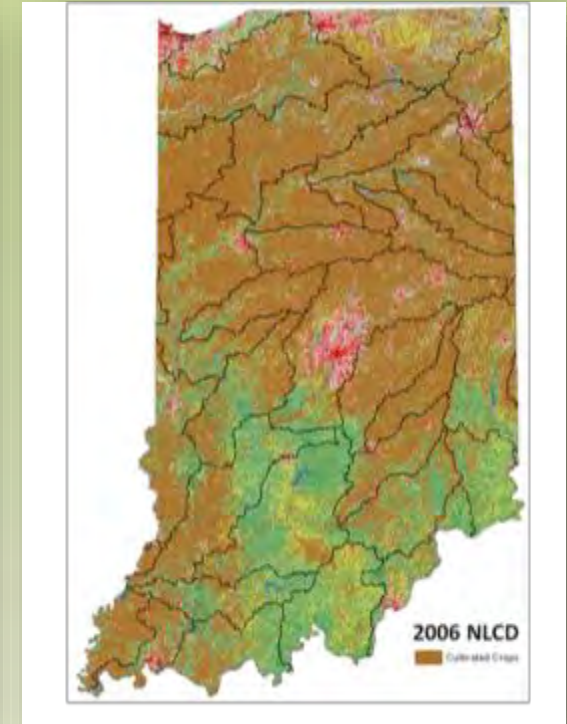
[www.nrcs.usda.gov](http://www.nrcs.usda.gov)



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# Conservation Cropping Systems



**Incomplete System = more runoff & less water-holding capacity**

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

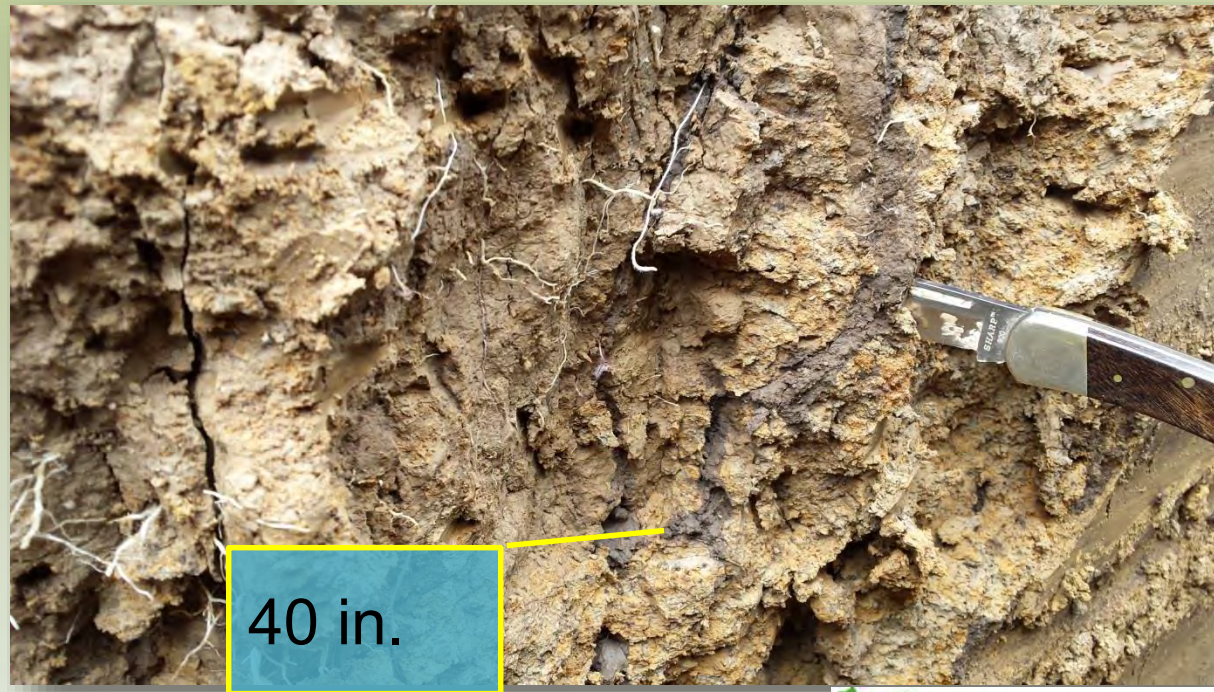
**SOLUTION = Conservation Cropping Systems on a watershed scale**

## 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



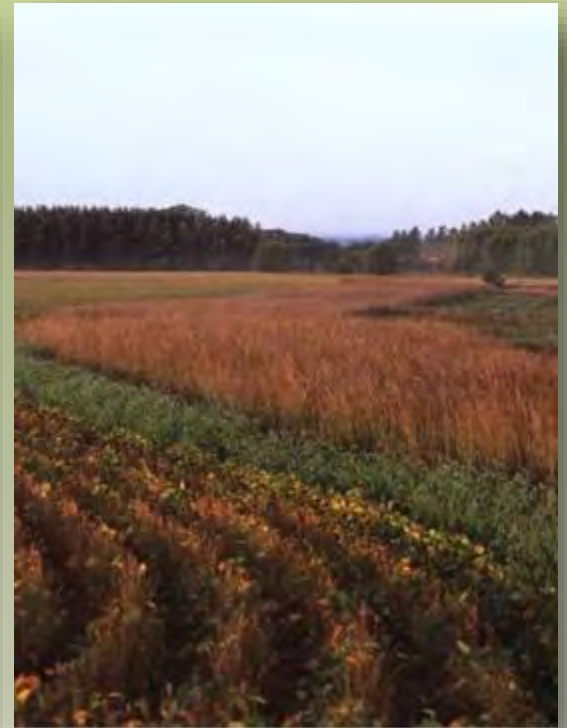
# Conservation Cropping Systems



**Incomplete System =  
no cover, minimal  
biology**



**Healthy Soil Biota  
Pollinators**



**SOLUTION =  
Conservation Cropping  
Systems**

## Wildlife



# Conservation Cropping Systems

Virginia



System

Incomplete System

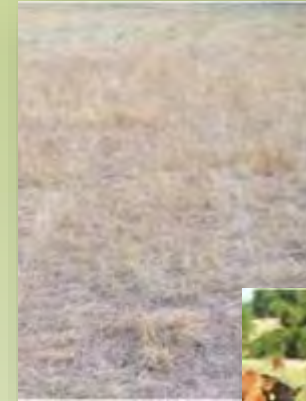
Indiana



System

Incomplete System

Missouri



Unmanaged Pasture

Managed Pasture System



Stable, Sustainable Food Supply

## Risk Reduction

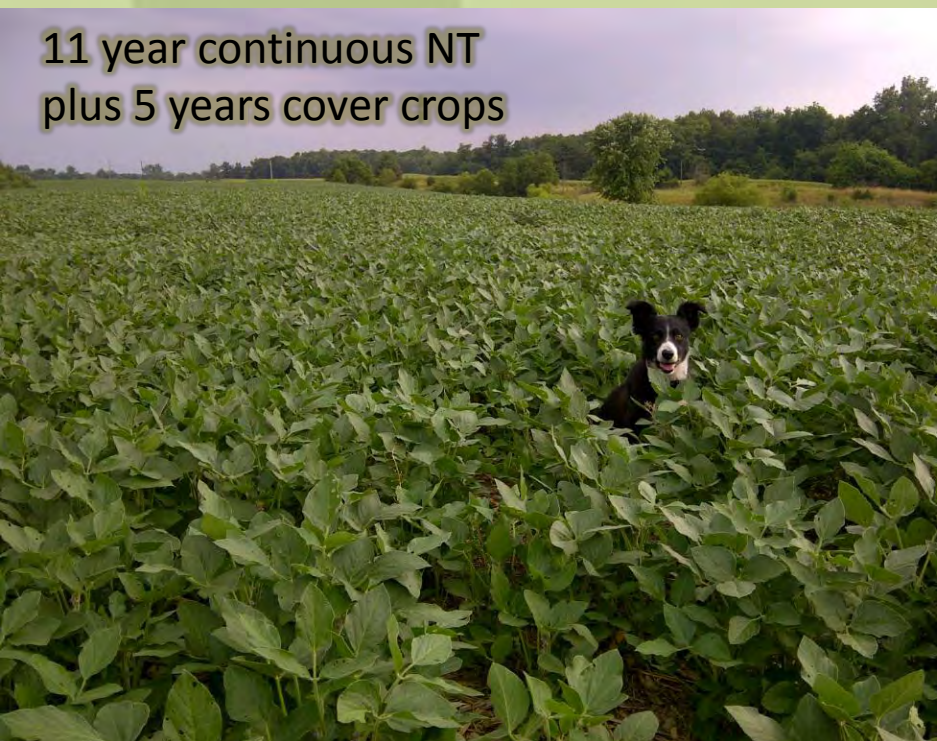
“Insurance” against drought, floods, markets



# “Insurance”

## July 8, 2012 4:30 p.m.

11 year continuous NT  
plus 5 years cover crops



Minimum/vertical till  
across the fence





# Conservation Cropping Systems



**Incomplete System =  
Higher likelihood for  
environmental concerns**



**Gully Erosion Repair**

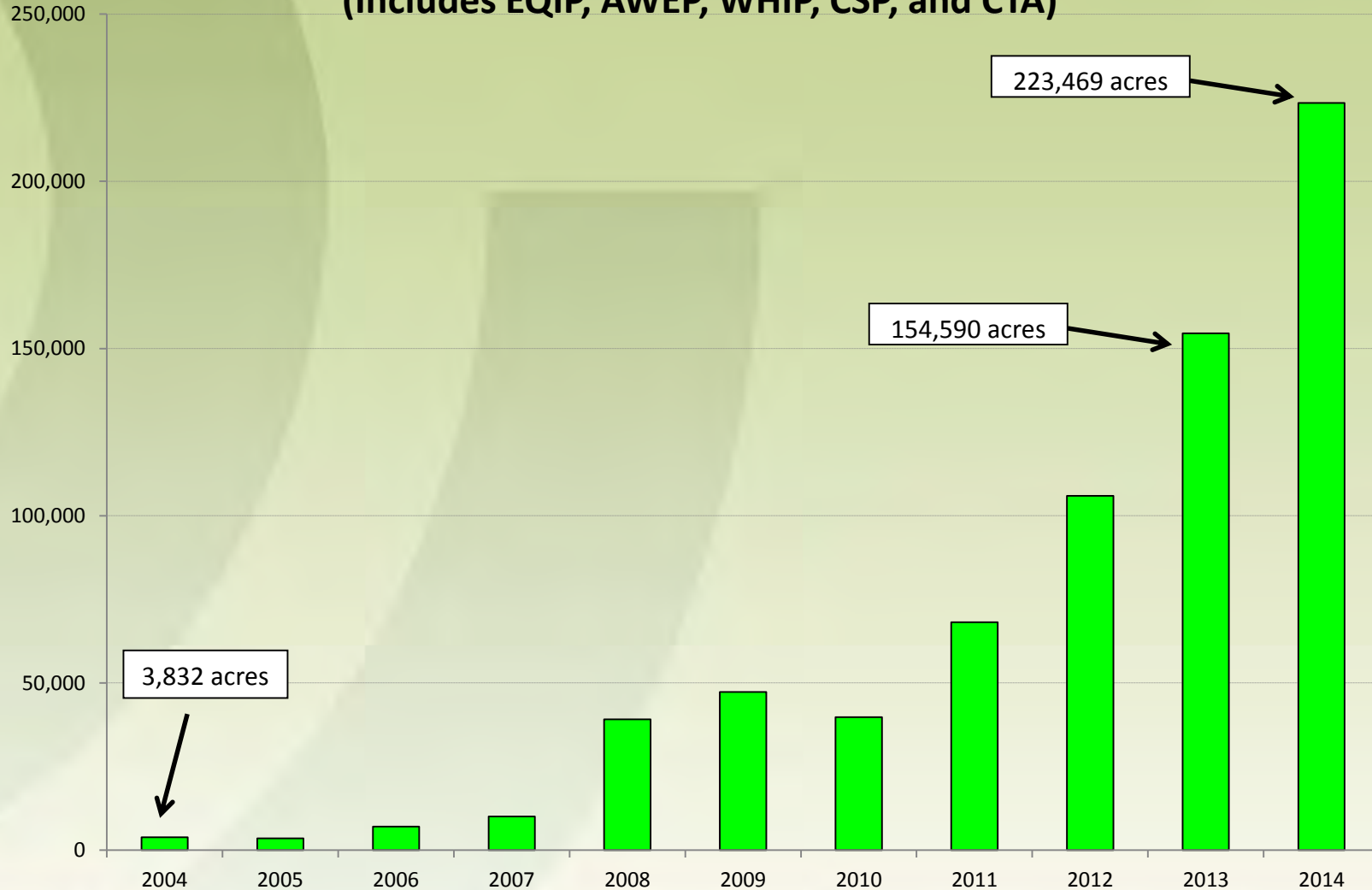


**SOLUTION = Conservation  
Cropping Systems**

## Public Cost Savings

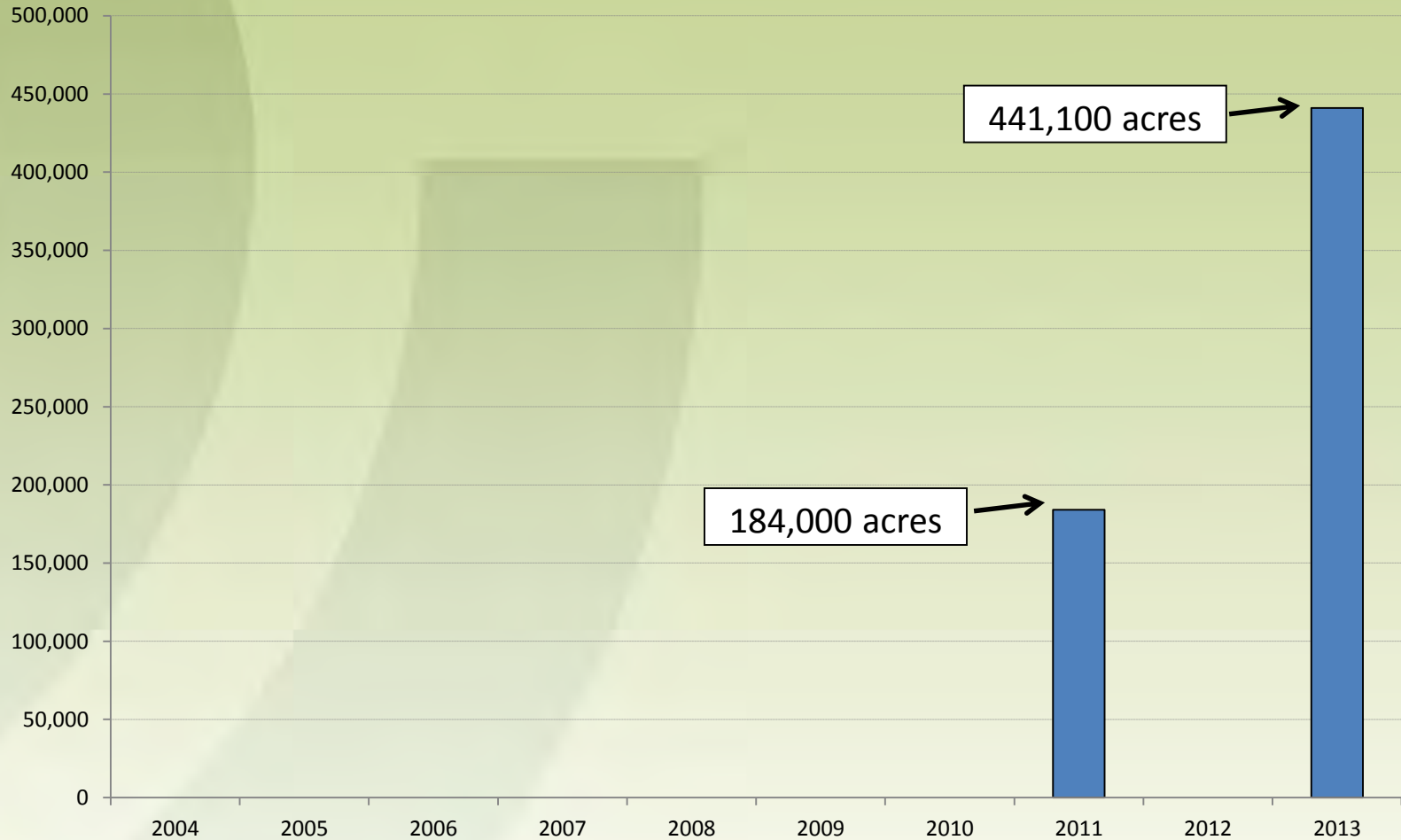


## INDIANA PRS-REPORTED APPLIED COVER CROP ACRES (Includes EQIP, AWEF, WHIP, CSP, and CTA)



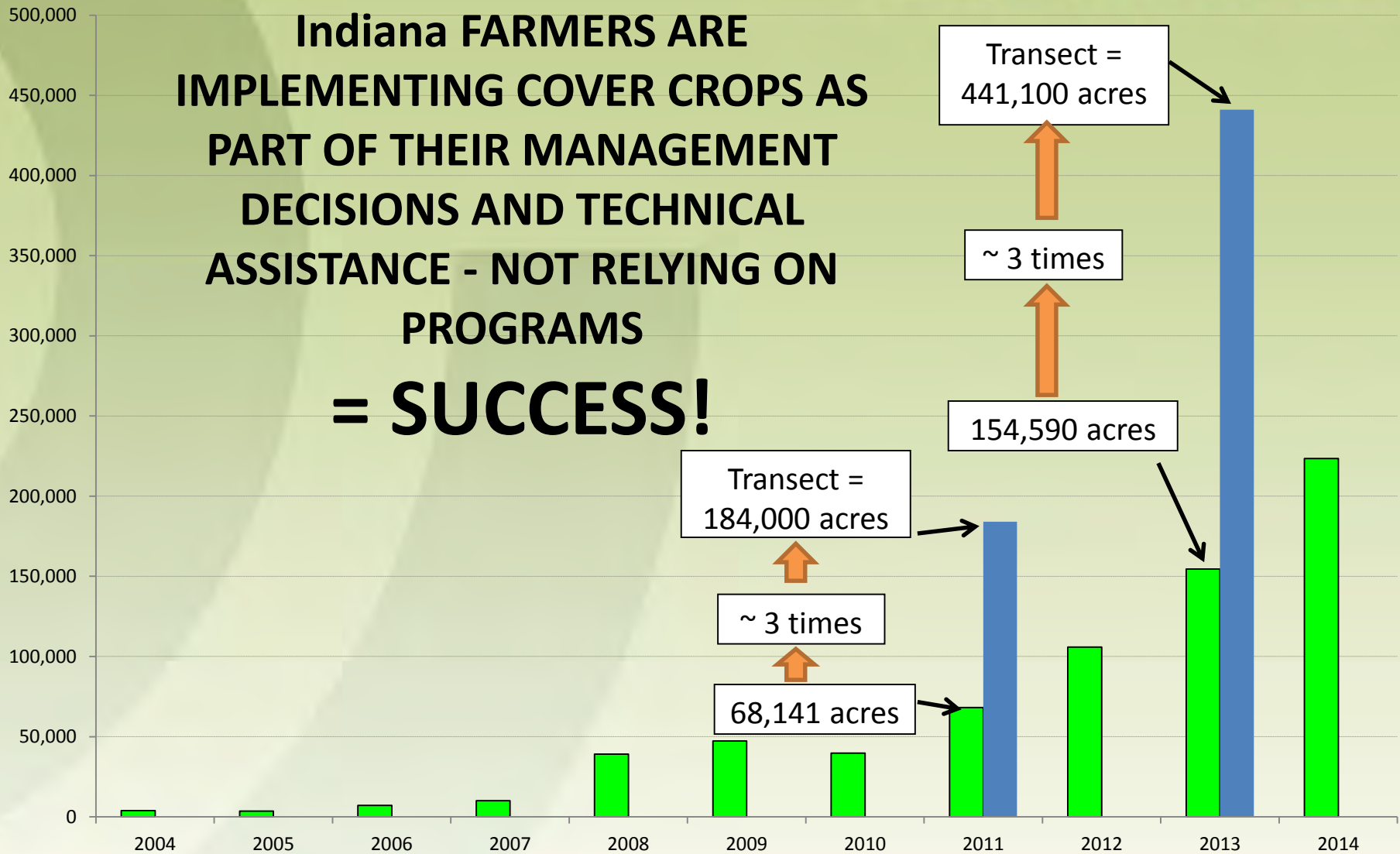


## INDIANA TILLAGE TRANSECT COVER CROP ACRES NRCS Customers and Others





**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/>

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Dig A Little, Learn A Lot

## Unlock the Secrets in the Soil

Soil is a living and life-giving substance, without which we would perish.

As world population and food production demands rise, keeping our soil healthy and productive is of paramount importance. So much so that we believe improving the health of our Nation's soil is one of the most important endeavors of our time.

By focusing more attention on soil health and by educating our customers and the public about the positive impact healthy soils can have on productivity and conservation, we can help our Nation's farmers and ranchers feed the world more profitably and sustainably – now and for generations to come.

The resources on this soil health section of our site are designed to help visitors understand the basics and benefits of soil health – and to learn about Soil Health Management Systems from farmers who are using those systems.

So whether you're a farmer, a researcher, a conservationist or an interested citizen, the information on this site will help you "Unlock the Secrets in the Soil."

### Voices of Soil Health



Share  More info



WE'RE ON A SOIL HEALTH KICK.

ARE YOU?



**USDA - NRCS**

*Making Soil Health Our #1 Priority*

# Questions?

**For More Information:  
[www.in.nrcs.usda.gov](http://www.in.nrcs.usda.gov)**