Soil Health Case Studies: Quantifying Economic, Water Quality, & Climate Outcomes

Michelle Perez, PhD – AFT Project Leader & Water Director

ACWA NUTRIENTS POLICY CMTE WEBINAR
MARCH 23, 2020
OVERVIEW
Overview Outline

• Distribution of 8 AFT-NRCS Soil Health Case Studies via keyword on the web:
  
  “FIC soil health case studies”

• Overview of AFT SH CIG Project

• Overarching Findings

• Uses of the Case Studies
Why quantify soil health outcomes?

- Evidence that no-till/strip-till, cover crops, nutrient management improve water quality & soil health

- Not much information about economic benefits linked with better soil health

- The agricultural community (farmers, retailers, landlords, bankers, etc.) want to know the “bottom line”
Project Goal

Drive adoption of soil health practices by:

✓ Quantifying the economic & environmental outcomes associated with these management changes

✓ Increasing awareness

✓ Developing a persuasive education tool to help convince farmers to adopt these practices on owned and rented land

✓ Improving landowner and operator communication and interaction
Meet the Team

Michelle Perez
Project Leader
Water Initiative Director

Florence Swartz
Project Economist
Retired NRCS NY Economist
Meet the AFT Authors

Justin Bodell  
CA Stewardship Manager

Paul Lum  
CA Project Manager

Emily Bruner, PhD  
Midwest Science Director, IL

Brian Brandt  
Ag Innovations Director, OH

Aaron Ristow  
NY Stewardship Mgr
External Reviewers

- NRCS Economists
  - Lynn Knight, Economist, East Region
  - Bryon Kirwan, Illinois State Economist
  - Lakeitha Ruffin, Oregon State Economist
  - Richard Lovanna, FSA Economist
  - Sophia Glenn, NRCS Economist
  - Sarah Cline, NRCS Economist

- NRCS Soil Health Specialists
  - Kabir Zahangir
    West Regional Soil Health Specialist
  - James Hoorman
    NE Regional Soil Health Specialist
  - Candy Thomas, NRCS SH Specialist
  - Justin Morris, NRCS SH Specialist
  - Barry Fisher, NRCS SH Specialist

- University Economists
  - John Hanchar
    Cornell Cooperative Extension
  - Gary Schnitkey
    University of Illinois
  - Brent Sohngen
    Ohio State University

- NTT Reviewer
  - Mindy Selman, USDA
    Office of Ecosystem Markets

- COMET-Farm Reviewer
  - Matthew Stermer & Mark Easter
    Colorado State University
Soil Health Case Study
Tom and Dan Rogers, CA

Introduction
Tom and Dan Rogers are dedicated to improving soil health on their 160-acre farm near the heart of the San Joaquin Valley. Their family has been farming the land for generations, but they recognized the need for a more sustainable approach.

Soil Health, Economic, Water Quality, and Climate Benefits
By adopting conservation practices, Tom and Dan have seen a significant improvement in soil health. The farm now supports a diverse ecosystem, reducing erosion and increasing water infiltration. The economic benefits include reduced input costs and increased crop yields. Water quality has improved due to less runoff and leaching.

Farms at a glance
Tom and Dan Rogers Farm

Soil Health Case Study
Larry, Adam, and Josh Hurl, Yorkton, IL

Introduction
Larry, Adam, and Josh have been farming together for over 10 years. They are passionate about soil health and have implemented a range of practices to improve their land.

Soil Health, Economic, Water Quality, and Climate Benefits
By focusing on rotations and cover crops, Larry, Adam, and Josh have noticed a decline in soil erosion and an increase in organic matter. This has led to improved crop yields and reduced input costs. Water quality has improved as well, with less runoff and leaching.

Farms at a glance
Larry, Adam, and Josh Hurl Farm

Soil Health Case Study
Dan Lang, Homestead Farms, OH

Introduction
Dan Lang operates a 500-acre farm in Ohio. He is focused on sustainable practices that improve soil health and support biodiversity.

Soil Health, Economic, Water Quality, and Climate Benefits
Through the use of no-till farming and the incorporation of cover crops, Dan has observed a significant improvement in soil health. This has translated into increased crop yields and reduced input costs. Water quality is also better, with less runoff and leaching.

Farms at a glance
Dan Lang Farm

Soil Health Case Study
Jay Svede, Gary Svede Farm LLC, NY

Introduction
Jay Svede has been farming in New York for over 20 years. He is committed to sustainable practices that enhance soil health.

Soil Health, Economic, Water Quality, and Climate Benefits
By adopting no-till practices and cover crops, Jay has seen a marked improvement in soil health. This has led to increased crop yields and reduced input costs. Water quality has also improved, with less runoff and leaching.

Farms at a glance
Jay Svede Farm LLC

Soil Health Case Study
Eric Haenel, Maanen Farms, IL

Introduction
Eric Haenel farms 300 acres in Illinois. He is dedicated to improving soil health through the use of cover crops and reduced tillage.

Soil Health, Economic, Water Quality, and Climate Benefits
Through the implementation of cover crops and reduced tillage, Eric has observed a significant improvement in soil health. This has led to increased crop yields and reduced input costs. Water quality has also improved, with less runoff and leaching.

Farms at a glance
Eric Haenel Farm

Soil Health Case Study
John and Jim Mackey, Mackey Farms LLC, NY

Introduction
John and Jim Mackey farm 500 acres in New York. They are focused on sustainable practices that enhance soil health.

Soil Health, Economic, Water Quality, and Climate Benefits
By adopting cover crops and reduced tillage, John and Jim have seen a marked improvement in soil health. This has led to increased crop yields and reduced input costs. Water quality has also improved, with less runoff and leaching.

Farms at a glance
John and Jim Mackey Farm LLC

Soil Health Case Study
Ralf Solton, Okuha Farms, CA

Introduction
Ralf Solton operates a 200-acre farm in California. He is committed to sustainable practices that improve soil health.

Soil Health, Economic, Water Quality, and Climate Benefits
Through the adoption of no-till farming and the use of cover crops, Ralf has observed a significant improvement in soil health. This has led to increased crop yields and reduced input costs. Water quality has also improved, with less runoff and leaching.

Farms at a glance
Ralf Solton Farm

Soil Health Case Study
Jim, Adam, and Beth Thomsby, Thomthes Farms, IL

Introduction
Jim, Adam, and Beth farm 400 acres in Illinois. They are dedicated to sustainable practices that enhance soil health.

Soil Health, Economic, Water Quality, and Climate Benefits
By adopting cover crops and reduced tillage, Jim, Adam, and Beth have seen a marked improvement in soil health. This has led to increased crop yields and reduced input costs. Water quality has also improved, with less runoff and leaching.

Farms at a glance
Jim, Adam, and Beth Thomsby Farm
8 Soil Health Case Studies
METHODS FOR ECONOMIC ANALYSIS
Economic Methods

- Partial budget analysis:
  - Estimates the economic effect (benefits and costs) of changes in a farming operation
  - Focuses only on variables affected by the change
  - Compares costs & benefits “before” & “after” soil health practice implementation

- Primary effects evaluated:
  1. Machinery
  2. Fertilizer
  3. Pesticide
  4. Yield
  5. Erosion repair
  6. Learning costs
  7. Other
Example of Partial Budget Analysis

### Economic Effects of Soil Health Practices on Gary Swede Farm, LLC (2018)

#### Increases in Net Income

<table>
<thead>
<tr>
<th>Item</th>
<th>Increase in Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield Impact Due to Soil Health Practice</td>
<td>$71.95</td>
</tr>
<tr>
<td>Total Increased Income</td>
<td>$43,168</td>
</tr>
</tbody>
</table>

#### Decreases in Net Income

<table>
<thead>
<tr>
<th>Item</th>
<th>Decrease in Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>None Identified</td>
<td></td>
</tr>
<tr>
<td>Total Decreased Income</td>
<td>$0</td>
</tr>
</tbody>
</table>

#### Decrease in Cost

<table>
<thead>
<tr>
<th>Item</th>
<th>Decrease in Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduced Machinery Cost due to Reduced Tillage</td>
<td>$23.43</td>
</tr>
<tr>
<td>Nutrient Savings due to Nutrient Mngmnt.</td>
<td>$40.65</td>
</tr>
<tr>
<td>Value of Decreased Erosion due to Soil Health Practices</td>
<td>$2.25</td>
</tr>
<tr>
<td>Total Decreased Cost</td>
<td>$62,911</td>
</tr>
</tbody>
</table>

#### Increase in Cost

<table>
<thead>
<tr>
<th>Item</th>
<th>Increase in Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of Setting up Planter to Handle Residue</td>
<td>$0.72</td>
</tr>
<tr>
<td>Cover Crop Costs</td>
<td>$51.00</td>
</tr>
<tr>
<td>Residue and Tillage Management Learning Activities</td>
<td>$0.07</td>
</tr>
<tr>
<td>Cover Crops Learning Activities</td>
<td>$0.22</td>
</tr>
<tr>
<td>Nutrient Management Learning Activities</td>
<td>$0.16</td>
</tr>
<tr>
<td>Total Increased Cost</td>
<td>$23,822</td>
</tr>
</tbody>
</table>

#### Total Net Returns

- Total Net Returns = $82,257
- Per Acre Net Return = $55
- Return on Investment = 345%

American Farmland Trust
NTT is a free online tool for estimating N, P and sediment losses from crop and pasture.
COMET-Farm – Greenhouse Gases

Whole farm and ranch carbon and GHG accounting system
Jay Swede, NY, diversified crop rotation

- Genesee County Genesee River Watershed;
- Sweet corn, alfalfa, corn silage, grain corn
- **Study area:** 1,500 / 4,500 acres
- No-till, strip-till, cover crops, & nutrient management
  - Cover crops: 450/ac/yr, oats, wheat, radishes or a mix in sweet corn after alfalfa, and corn silage

**Annual SH Benefits:** $106,079  
**Annual SH Costs:** $23,822  
**Annual SH PROFITS:** $82,257 or $55/ac  
(2018 dollars)

**343% ROI**

**NTT results:** On a 25-acre field, N, P, & sediment reduced by 40, 92, & 96%

**COMET results:** Same field, total GHG reduced by 560%, taking 3 cars off road
## Increases in Net Income

<table>
<thead>
<tr>
<th>ITEM</th>
<th>PER ACRE</th>
<th>ACRES</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield Impact Due to Soil Health Practices</td>
<td>$71.95</td>
<td>600</td>
<td>$43,168</td>
</tr>
<tr>
<td><strong>Total Increased Income</strong></td>
<td></td>
<td></td>
<td><strong>$43,168</strong></td>
</tr>
</tbody>
</table>

## Decrease in Cost

<table>
<thead>
<tr>
<th>ITEM</th>
<th>PER ACRE</th>
<th>ACRES</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduced Machinery Cost due to Reduced Tillage</td>
<td>$23.43</td>
<td>1,500</td>
<td>$35,152</td>
</tr>
<tr>
<td>Nutrient Savings due to Nutrient Mngmnt.</td>
<td>$40.65</td>
<td>600</td>
<td>$24,390</td>
</tr>
<tr>
<td>Value of Decreased Erosion due to Soil Health Practices</td>
<td>$2.25</td>
<td>1,500</td>
<td>$3,369</td>
</tr>
</tbody>
</table>

**Total Decreased Cost** **$62,911**

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Increased Net Income</td>
<td></td>
<td></td>
<td>$106,079</td>
</tr>
<tr>
<td>Total Acres in the Study Area</td>
<td></td>
<td></td>
<td>1,500</td>
</tr>
<tr>
<td>Per Acre Increased Net Income</td>
<td></td>
<td></td>
<td>$71</td>
</tr>
</tbody>
</table>
# Decreases in Net Income

<table>
<thead>
<tr>
<th>Item</th>
<th>Per Acre</th>
<th>Acres</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>None Identified</td>
<td></td>
<td></td>
<td>$0</td>
</tr>
<tr>
<td><strong>Total Decreased Income</strong></td>
<td></td>
<td></td>
<td><strong>$0</strong></td>
</tr>
</tbody>
</table>

## Increase in Cost

<table>
<thead>
<tr>
<th>Item</th>
<th>Per Acre</th>
<th>Acres</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of Setting up Planter to Handle Residue</td>
<td>$0.72</td>
<td>600</td>
<td>$432</td>
</tr>
<tr>
<td>Cover Crop Costs</td>
<td>$51.00</td>
<td>450</td>
<td>$22,950</td>
</tr>
<tr>
<td>Residue and Tillage Mgmt. Learning Activities</td>
<td>$0.07</td>
<td>1,500</td>
<td>$98</td>
</tr>
<tr>
<td>Cover Crops Learning Activities</td>
<td>$0.22</td>
<td>450</td>
<td>$98</td>
</tr>
<tr>
<td>Nutrient Management Learning Activities</td>
<td>$0.16</td>
<td>1,500</td>
<td>$244</td>
</tr>
<tr>
<td><strong>Total Increased Cost</strong></td>
<td></td>
<td></td>
<td><strong>$23,822</strong></td>
</tr>
<tr>
<td>Annual Total Decreased Net Income</td>
<td></td>
<td></td>
<td>$23,822</td>
</tr>
<tr>
<td>Total Acres in this Study Area</td>
<td></td>
<td></td>
<td>1,500</td>
</tr>
<tr>
<td>Annual Per Acre Decreased Net Income</td>
<td></td>
<td></td>
<td>$16</td>
</tr>
</tbody>
</table>
OVERARCHING FINDINGS
Yield & Income Benefits of Soil Health Practices Across Six Crop Farms

- **Improved Yield:**
  - 1 farm reported no yield change while
  - 5 reported *yield increases*
  - Range: 2% to 22% for at least one of the crops grown

- **Annual Change in Per Acre Net Income:**
  - 6 farms reported increases
  - Average increase: $41/ac/yr
  - Range: $22 to $56/ac/yr

- **Return on Investment:**
  - 6 farms reported positive ROI
  - Average was 151%
  - Range was 35% to 343%
Input Benefits & Costs of Soil Health Practices Across Six Farms

- **Changes to Fertilizer Costs:**
  - 1 farm increased costs while
  - 5 farms reduced costs
  - Average savings: $36/ac/yr
  - Range: $18 & $66/ac/yr

- **Changes to Machinery, Fuel, and Labor Costs due to Change in Tillage:**
  - 1 farm reported no change while
  - 5 farms reduced costs
  - Average savings: $31/ac/yr
  - Range: $20 to $60/ac/yr
Input Benefits & Costs of Soil Health Practices Across Six Farms

- **Pesticide Usage:** (Herbicide, Insecticide, and Fungicide)
  - 2 farms reported no change while
  - 4 farms reported changes
  - 2 farms increased by an average of $8/ac/yr; Range: $5 & $11/ac/yr
  - 2 farms decreased by average of $17/ac/yr; Range: $15 to $19/ac/yr

- **Learning Costs:**
  - Average: $3.12/ac/yr
  - Ranged from $440 to $12,940/yr or 44 cents to $10.35/ac/yr
Environmental Benefits of Soil Health Practices Across all Six Farms

- **Water Quality Improvement:**
  All 6 row crop farmers *observed* reduced soil and water runoff
  On selected fields, NTT estimated:
  - Average reduction in N losses was 61% (range was 23 to 72%); 
  - Average reduction in P losses was 74% (range was 33 to 92%); 
  - Average reduction in sediment losses was 81% (range was 37 to 99%)

- **Climate Improvement:**
  On selected fields, COMET-Farm estimated total GHG emissions were reduced an average of **217%** (range was 35 to 560%)
Uses of the Case Studies by the Conservation Community

We hope:

- **Government partners** - NRCS, SWCD, & Extension
- **Non-profits** – ACWA, Field-to-Market, ESMC
- **Private sector** - Ag retailers, crop consultants, cover crop seed dealers, strip-till equipment providers, etc.

Use the case studies with their farm customers to help answer questions about the costs & benefits of adopting soil health practices.
Farmer Uses of the Case Studies

We hope farmers will:

- Read the case studies & try one soil health practice w/ or w/o help
  AFT, 2 ag retailers, NRCS, & SWCD are at the ready to help

- Say “yes” to a “Predictive Assessment”
  AFT is offering 4 “soil health curious farmers” the service of running “what if” scenarios => potential, future economic, water quality, & climate benefits
Farmer Uses of the Case Studies

We hope farmers will share the case studies with:

- **Existing landowners** - To discuss sharing the risks and rewards of the soil health investments

- **New landowners** – To add new fields

- **Bankers** – To secure additional financing for the farm expansion
Thank you & More Info

Michelle Perez, PhD
Water Initiative Director
mperez@farmland.org

Download the case studies at:
farmland.org/soilhealthcasestudies

To sign-up for a training, email:
SHtraining@farmland.org

Let us know if you use the case studies in your projects with farmers as an outreach & education material!