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

• Why quantify soil health outcomes?

• Project Overview
  • Team
  • Goals
  • Methods

• Project Results
Why quantify soil health outcomes?

- Several examples of anecdotal & scientific evidence supporting the environmental & soil health benefits of conservation practices

- Less information available quantifying the on-farm economic benefits associated with improving soil health

- The agricultural community (including retailers, bankers, landlords, farmers, and others) continuously request information that considers the “bottom line”
Why quantify soil health outcomes?

- From NRCS:
  "With soil health management, producers can increase profits and reduce costs and risk all while conserving our nation's resources for the benefit of all. .....the extent of these economic benefits has not been consistently quantified – a major constraint to soil health management adoption identified as a priority by NRCS, partners, and customers"
Other economic case studies

- NACD & Datu (2017)
  4 farmers; 16-page each; partial budget analysis

- EDF (2018)
  2 farmers; total enterprise budgets

- NRCS NY (2017)
  2 farmers: Kemmeren & Magos; 2-pages each; PBA
Meet the Team

Michelle Perez
Project Leader
AFT Water Initiative Director

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

Justin Bodell
CA Stewardship Manager

Brian Brandt
Ag Innovations Director, OH

Emily Bruner
Midwest Science Director

Aaron Ristow
NY Stewardship Mgr
External Reviewers

- **NRCS Economists**
  - Bryon Kirwan, State Economist of Illinois
  - Lynn Knight, Economist, East Region
  - Lakeitha Ruffin, State Economist of Oregon

- **NRCS Soil Health Specialists**
  - Kabir Zahangir, West Regional Soil Health Specialist
  - James Hoorman, NE Region Soil Health Specialist

- **NTT Reviewer**
  - Mindy Selman, USDA OEM

- **COMET-Farm Reviewer**
  - Matthew Stermer, Colorado State University
Project Goal

Drive adoption of soil health practices by:

- Quantifying the economic and environmental outcomes associated with these management changes
- Developing a persuasive education tool to convince farmers to adopt these practices on owned and rented land
- Increasing awareness
- Improving landowner and operator communication and interaction
DESIGNING THE PROJECT
Locations selected to leverage already existing AFT work

- California: Lower Stanislaus River Watershed
- Illinois: Vermilion Headwaters Watershed
- Ohio: Portage and Toussaint Watershed
- New York: Genesee River Basin Watershed
Materials developed for the Authors

- Criteria to Identify Soil Health Successful Farmers
- 4-page Handout: About the Project; Why Participate; Consent Form; Questionnaire Explanation
- List of Information to Collect Ahead of Time
- 20-page Questionnaire in Word
- 11-tab Excel Economic Calculator
- 6-tab NTT & COMET Questionnaire in Excel
- Case Study Template
### Data Sources:

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<th>Item</th>
<th>Source</th>
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<tr>
<td>Labor Rate: 45-1011 First-Line Supervisors of Farming, Fishing, and Forestry Workers</td>
<td>Bureau of Labor Statistics - 2018 Labor Rates</td>
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<td>Machinery Cost Estimates</td>
<td>Field Operations, Farm Business Mngmnt., University of Illinois, June 2017</td>
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<td>Machinery Costs for Fertilizer Application</td>
<td>2018 Iowa Farm Custom Rate Survey, Iowa State University Extension and Outreach</td>
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<td>Fertilizer Prices</td>
<td>Estimated Costs of Crop Production in Iowa - 2018</td>
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<td>Index for Agricultural Costs</td>
<td>Producer Prices Paid Index, National Agricultural Statistics Service</td>
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<td>Crop Prices - Non-organic, Hay/Forage</td>
<td>Agricultural Prices, NASS, February 29, 2019</td>
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<td>Crop Prices - Organic Wheat</td>
<td>Baking Business November 2018 Prices</td>
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<td>Nutrient Values</td>
<td>Estimated Costs of Production in Iowa, Iowa State University Extension and Outreach</td>
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<td>Value of Nutrients in Soil (for erosion reduction benefit)</td>
<td>Interim Final Benefit-Cost Analysis for the Environmental Quality Incentives Program, 2009</td>
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<tr>
<td>Net Returns, Corn, Soybeans, Production Costs, Hay</td>
<td>Commodity Costs and Returns, Economic Research Service</td>
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<td>National Average Hay Yield</td>
<td>Statistics by Subject, NASS, 2018</td>
</tr>
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</table>
COMET FARM

http://cometfarm.nrel.colostate.edu/
THE RESULTS
4 AFT-NRCS Soil Health Case Studies

Soil Health Case Study
Ralf Sauter, Okuye Farms

Introduction
Ralf Sauter and his family grow almonds on 110 acres of flat, sandy loam soil in Merced County, California. The land has been in the family for over 100 years and is protected from development by a conservation easement. Five years ago, Ralf took over the operations from his mother-in-law and has since moved the family from Germany to the San Joaquin Valley.

Soil
Ralf credits increased adoption of soil health practices to the implementation of a series of adaptive practices, including cover crops, compost, and improved soil fertility practices. As a result, his farm has seen improvements in soil health, including increased water infiltration and reduced erosion.

Soil Health Benefits
Soil health has a significant impact on farm productivity and profitability. In Ralf's case, the benefits include improved soil structure, increased water infiltration, and reduced soil erosion. These improvements have led to increased yields and reduced input costs, ultimately increasing profit margins.

Soil Health Case Study
Larry, Adam, and Beth Thorndyke

Introduction
Larry Thorndyke is a fifth-generation farmer who has been farming the 1,200-acre farm for over 40 years. The farm is located in the Upper Midwest and primarily grows corn, soybeans, and small grains. Larry credits his family's success to their commitment to soil health practices and the development of a sustainable farming system.

Soil
Larry's farm is a model of sustainable agriculture, with a focus on soil health and conservation practices. The farm has implemented a variety of soil health practices, including cover crops, no-till systems, and Conservation Reserve Program (CRP) practices.

Soil Health Benefits
Larry's farm has seen significant improvements in soil health, including increased water infiltration, reduced soil erosion, and improved plant health. These improvements have led to increased yields and reduced input costs, ultimately increasing profit margins.

Soil Health Case Study
Eric Niemeyer, MadMax Farms

Introduction
Eric Niemeyer is a second-generation farmer who has been farming his 1,000-acre farm for over 20 years. The farm is located in the Upper Midwest and primarily grows corn, soybeans, and small grains. Eric credits his family's success to their commitment to soil health practices and the development of a sustainable farming system.

Soil
Eric's farm is a model of sustainable agriculture, with a focus on soil health and conservation practices. The farm has implemented a variety of soil health practices, including cover crops, no-till systems, and Conservation Reserve Program (CRP) practices.

Soil Health Benefits
Eric's farm has seen significant improvements in soil health, including increased water infiltration, reduced soil erosion, and improved plant health. These improvements have led to increased yields and reduced input costs, ultimately increasing profit margins.

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

Introduction
Jay Swede is a third-generation farmer who has been farming his 400-acre farm for over 30 years. The farm is located in the Northeast and primarily grows corn, soybeans, and small grains. Jay credits his family's success to their commitment to soil health practices and the development of a sustainable farming system.

Soil
Jay's farm is a model of sustainable agriculture, with a focus on soil health and conservation practices. The farm has implemented a variety of soil health practices, including cover crops, no-till systems, and Conservation Reserve Program (CRP) practices.

Soil Health Benefits
Jay's farm has seen significant improvements in soil health, including increased water infiltration, reduced soil erosion, and improved plant health. These improvements have led to increased yields and reduced input costs, ultimately increasing profit margins.
4 AFT-NRCS Soil Health Case Studies

Ralf Sauter, Okuye Farms, CA

The cost of the micro-irrigation system installed on 2000 acres was roughly $40,000, with the added 950-cost per acre of wholesale production form from previous to present. Sauter now grows strawberries and blackberries, with yields of 55,000 pounds per acre.

The NRCS conducted a soil health assessment at Okuye Farms in 2018, which revealed a 12% increase in organic matter and a 26% increase in aggregate stability. Sauter has also expanded his operations to include the cultivation of hops, with yields of 10,000 pounds per acre.

Economic Impact

Incomes and Employment

Agricultural Income

Sauter’s farm employs 20 full-time workers and 30 part-time workers, with a total of 65 full-time equivalents (FTEs) on the farm. The farm generates an annual income of $1.2 million, with a payroll of $600,000.

Savings from Reduced Inspections

The farm has reduced its inspections from 12 to 6, resulting in a savings of $6,000 per year.

For more information about this study, please contact: Ralf Sauter, Okuye Farms, CA

Larry, Adam, and Beth Throndyke, Throntyde Farms, IL

The Throntyke family has been farming in the area for over 50 years, with a focus on growing soybeans, corn, and wheat. The farm has 1,200 acres of cropland, with yields of 150 bushels per acre.

Economic Impact

Incomes and Employment

Agricultural Income

The farm generates an annual income of $750,000, with a payroll of $200,000.

Savings from Reduced Inspections

The farm has reduced its inspections from 10 to 5, resulting in a savings of $5,000 per year.

For more information about this study, please contact: Larry Throntyde, Throntyde Farms, IL

Eric Niemeyer, MadMax Farms, OH

Niemeyer’s farm has been in operation for 30 years, with a focus on growing corn and soybeans. The farm has 500 acres of cropland, with yields of 160 bushels per acre.

Economic Impact

Incomes and Employment

Agricultural Income

The farm generates an annual income of $450,000, with a payroll of $150,000.

Savings from Reduced Inspections

The farm has reduced its inspections from 12 to 6, resulting in a savings of $6,000 per year.

For more information about this study, please contact: Eric Niemeyer, MadMax Farms, OH

Jay Swede, Gary Swede Farm LLC, NY

Swede’s farm has been in operation for 40 years, with a focus on growing wheat and barley. The farm has 400 acres of cropland, with yields of 60 bushels per acre.

Economic Impact

Incomes and Employment

Agricultural Income

The farm generates an annual income of $300,000, with a payroll of $100,000.

Savings from Reduced Inspections

The farm has reduced its inspections from 10 to 5, resulting in a savings of $5,000 per year.

For more information about this study, please contact: Jay Swede, Gary Swede Farm LLC, NY

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

<table>
<thead>
<tr>
<th>Practice</th>
<th>Increase in Net Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased organic matter</td>
<td>$15,000</td>
</tr>
<tr>
<td>Reduced tillage</td>
<td>$10,000</td>
</tr>
<tr>
<td>Improved water infiltration</td>
<td>$8,000</td>
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</tbody>
</table>

Reduced tillage saved the farm $10,000 per year, while increased organic matter and improved water infiltration each contributed $8,000 per year to the farm’s net income.

For more information about this study, please contact: Jay Swede, Gary Swede Farm LLC, NY

Clayton’s Farming

In a recent year, the corn costs were the lowest ever. Clayton has a new farm that he has been farming for the past three years. He has reduced his tillage from 5 to 2 passes, saving him $5,000 per year.

For more information about this study, please contact: Jay Swede, Gary Swede Farm LLC, NY

For more information about this case study or to discuss soil health practices, please contact: Aaron Robison, American Farmland Trust, New York Agriculture Stewardship Program Manager, at arobison@farmland.org. USFCS Wyanaco Office, 20 Center St, Westfield, NJ 07090. (908) 738-3700. To read more case studies, visit: farmland.org/soilhealthcasestudies
Economic benefits of soil health practices outweigh the costs of implementation

**Economic Effects of Soil Health Practices on Thorndyke Farms (2018)**

<table>
<thead>
<tr>
<th>Increases in Net Income</th>
<th>PER ACRE</th>
<th>ACRES</th>
<th>TOTAL</th>
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<tbody>
<tr>
<td>Yield Impacts due to Cover Crops</td>
<td>$12.95</td>
<td>700</td>
<td>$9,067</td>
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<td><strong>Total Increased Income</strong></td>
<td></td>
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<td><strong>$9,067</strong></td>
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<tr>
<td>Nutrient Savings Due to Nutrient Management</td>
<td>$66.00</td>
<td>700</td>
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<td>Reduced Machinery Cost due to Reduced Tillage</td>
<td>$17.68</td>
<td>1,400</td>
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<td>$2.73</td>
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<td><strong>Total Decreased Cost</strong></td>
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<td></td>
<td><strong>$74,761</strong></td>
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<tr>
<td>Annual Total Increased Net Income</td>
<td></td>
<td></td>
<td>$83,828</td>
</tr>
<tr>
<td>Total Acres in this Study Area</td>
<td></td>
<td></td>
<td>1,400</td>
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<tr>
<td>Annual Per Acre Increased Net Income</td>
<td></td>
<td></td>
<td>$60</td>
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<table>
<thead>
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<th>Decreases in Net Income</th>
<th>PER ACRE</th>
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<td>$0</td>
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<td><strong>Total Decreased Income</strong></td>
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<td></td>
<td><strong>$0</strong></td>
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<tr>
<td>Nutrient Management Learning Activities</td>
<td>$0.87</td>
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<td>Cover Crops Learning Activities</td>
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<td>Cover Crop Costs</td>
<td>$39.00</td>
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<td>Increased Pesticide Cost due to Reduced Tillage</td>
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<td><strong>Total Increased Cost</strong></td>
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<td><strong>$36,742</strong></td>
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<td>Annual Total Decreased Net Income</td>
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<td>$36,742</td>
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<td>Total Acres in this Study Area</td>
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<tr>
<td>Annual Per Acre Decreased Net Income</td>
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<td>$26</td>
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**Annual Change in Total Net Income = $47,086**

**Annual Change in Per Acre Net Income = $34**

**129% ROI**
Larry Thorndyke, IL, corn-soybeans

- Ford County, Vermilion Headwater Watershed
- **Soil health practices**: No-till & strip-till, cover crops, & nutrient management
- **Study area**: 1,400 / 2,600 acres

**Annual SH Benefits**: $83,828  
**Annual SH Costs**: $36,742  
**Annual SH PROFITS**: $47,086 or $34/ac  
(2018 dollars)

**NTT results**: On a 110-acre field, N, P, & sediment reduced by 45, 89, & 76%

**COMET results**: Same field, total GHGs emissions reduced by 192%

129% ROI
Economic benefits of soil health practices outweigh the costs of implementation

35% ROI

### Economic Effects of Soil Health Practices on MadMax Farms (2018)

<table>
<thead>
<tr>
<th>Increases in Net Income</th>
<th>Increase in Income</th>
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<tr>
<td>Yield Impact Due to Soil Health Practices</td>
<td>$69.00</td>
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<td><strong>$86,250</strong></td>
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<tr>
<td>Nutrient Savings due to Soil Health Practices</td>
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<tr>
<td>Reduced Seeding Rate for Soybeans</td>
<td>$5.00</td>
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<td>Pesticide Savings due to Soil Health Practices</td>
<td>$18.75</td>
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<td>50% Reduction in Treated Soybean Seed</td>
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<td>Reduced Machinery Costs due to Reduced Tillage</td>
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<td>Field Repair Savings due to Soil Health Practices</td>
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<thead>
<tr>
<th>Total Decreased Cost</th>
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<td>Annual Total Increased Net Income</td>
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<td>Total Acres in this Study Area</td>
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<tr>
<td>Annual Per Acre Increased Net Income</td>
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### Decreases in Net Income

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<td>Total Decreased Income</td>
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### Increase in Cost

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<tr>
<td>Variable Rate Application Cost</td>
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<tr>
<td>Increased Soil Testing Every Two Years</td>
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<tr>
<td>Residue and Tillage Mgt. Learning Activities</td>
<td>$1.17</td>
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<tr>
<td>Cover Crops Learning Activities</td>
<td>$5.86</td>
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<tr>
<td>Nutrient Management Learning Activities</td>
<td>$3.32</td>
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<tr>
<td>Using Biologicals in Furrow</td>
<td>$30.00</td>
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<td>Increased Machinery Costs due to Change in Nutrient Management</td>
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<td>Cover Crop Costs</td>
<td>$49.50</td>
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<table>
<thead>
<tr>
<th>Total Increased Cost</th>
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<tr>
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<td>Total Acres in this Study Area</td>
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<tr>
<td>Annual Per Acre Decreased Net Income</td>
<td>$109</td>
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</table>

Annual Change in Total Net Income = **$47,569**

Annual Change in Per Acre Net Income = **$38**
Eric Niemeyer, OH, corn-soybeans

- Marion & Delaware Counties, Upper Scioto River Watershed
- Soil health practices: No-till, cover crops, & nutrient management
- Study area: All 1,250 acres operation

**Annual SH Benefits:** $184,011  
**Annual SH Costs:** $136,442  
**Annual SH PROFITS:** $47,569 or $38/ac (2018 dollars)

35% ROI

**NTT results:** a 70-acre field N, P, & sediment reduced by 58, 74, 88%

**COMET results:** Same field, total GHG emissions reduced by 494%
Economic benefits of soil health practices outweigh the costs of implementation

343% ROI

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

<table>
<thead>
<tr>
<th>Increases in Net Income</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>
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<tr>
<td>Total Increased Income</td>
<td></td>
<td></td>
<td>$43,168</td>
</tr>
<tr>
<td>Reduced Machinery Cost due to Reduced Tillage</td>
<td>$23.43</td>
<td>1,500</td>
<td>$35,152</td>
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<tr>
<td>Nutrient Savings due to Nutrient Mgmt.</td>
<td>$40.65</td>
<td>600</td>
<td>$24,390</td>
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<td>Value of Decreased Erosion due to Soil Health Practices</td>
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<td>1,500</td>
<td>$3,369</td>
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<table>
<thead>
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<th>Decrease in Net Income</th>
<th>PER ACRE</th>
<th>ACRES</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
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<td>None Identified</td>
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<td>$0</td>
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<tr>
<td>Total Decreased Income</td>
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<td>$0</td>
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<table>
<thead>
<tr>
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<th>PER ACRE</th>
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<th>TOTAL</th>
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<tr>
<td>Cost of Setting up Planter to Handle Residue</td>
<td>$0.72</td>
<td>600</td>
<td>$432</td>
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<td>Cover Crop Costs</td>
<td>$51.00</td>
<td>450</td>
<td>$22,950</td>
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<td>Residue and Tillage Mgmt. Learning Activities</td>
<td>$0.07</td>
<td>1,500</td>
<td>$98</td>
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<td>Cover Crops Learning Activities</td>
<td>$0.22</td>
<td>450</td>
<td>$98</td>
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<tr>
<td>Nutrient Management Learning Activities</td>
<td>$0.16</td>
<td>1,500</td>
<td>$244</td>
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<table>
<thead>
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<th>Increase in Cost</th>
<th>PER ACRE</th>
<th>ACRES</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Total Decreased Net Income</td>
<td>$23,822</td>
<td></td>
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</tr>
<tr>
<td>Total Acres in this Study Area</td>
<td></td>
<td>1,500</td>
<td></td>
</tr>
<tr>
<td>Annual Per Acre Decreased Net Income</td>
<td></td>
<td></td>
<td>$16</td>
</tr>
</tbody>
</table>

Total Decreased Cost:
- Total Increased Net Income: $106,079
- Total Acres in the Study Area: 1,500
- Per Acre Increased Net Income: $71

Annual Change in Total Net Income = $82,257
Annual Change in Per Acre Net Income = $55
Jay Swede, NY, diversified crop rotation

- Genesee County Genesee River Watershed;
- Sweet corn, alfalfa, corn silage, grain corn
- **Soil health practices:** No-till, strip-till, cover crops, & nutrient management
- **Study area:** 1,500 / 4,500 acres

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

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

**COMET results:** Same field, total GHGs emissions reduced by 560%

343% ROI
OVERARCHING FINDINGS
Yield & Income Benefits of Soil Health Practices Across Three Farms

- **Improved Yield:**
  2 to 15% yield increases attributable to soil health practices

- **Annual Change in Per Acre Net Income:**
  Average increase for 3 row crop farmers was $42/ac/yr

- **Return on Investment:**
  Average ROI for 3 row crop farms was 169%, ranging from 35% to 343%
Input Benefits & Costs of Soil Health Practices Across Three Farms

- **Changes to Fertilizer Costs:**
  3 row crop farmers saving $17 to $66/ac/yr
  - reduced P applications 35 to 50%
  - reduced K applications 50%
  1 farmer reduced N on corn by 5%

- **Changes to Machinery, Fuel, and Labor Costs:**
  3 row crop farmers saving $18 to $35/ac/yr, averaging $26/ac/yr
Input Benefits & Costs of Soil Health Practices Across Three Farms

Herbicide Usage:
Mixed results:
1 farmer saves $19/ac/yr
1 farmer spends $5/ac/yr more
1 farmer was unchanged

Learning Costs:
Total cost ranged from $440 to $12,940/yr
Per acre costs range from 44 cents to $10.35
Environmental Benefits of Soil Health Practices Across all Four Farms

- **Water Quality Improvement:**
  3 row crop farmers observed reduced soil and water runoff.
  On selected fields, NTT estimated N losses were reduced 40 to 58%; P losses reduced 74 to 92%; & sediment losses reduced 76 to 96%.

- **Climate Improvement:**
  COMET-Farm estimated total GHG emissions were reduced on each field by 192 to 560%, equivalent to taking to 17 cars off the road.
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
STAY TUNED!
4 MORE CASE STUDIES IN REVIEW
THANK YOU!

AFT Site:
farmland.org/soilhealthcasestudies

NRCS Site:
https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/health/?cid=nrcseprd1470394

American Farmland Trust
19 + Tasks for Authors

1. Find Soil Health Successful Farmers that match the Criteria
2. Meet & discuss project with each farmer, complete the List of Things, complete signed consent form
3. Schedule interviews
4. Learn the 3 quantitative methods
5. Conduct economics interview, record it, & clean-up notes
6. Conduct NTT & COMET interview, record it, & clean-up
7. Enter economics data into the Calculator & compute results
8. Enter NTT data into NTT online & compute results
9. Enter COMET data into COMET online & compute results
10. Discuss economics results with Flo & Michelle
11. Discuss NTT results with Mindy Selman, NTT lead for USDA OEM
12. Discuss COMET results with Matt Stermer, COMET lead for CSU
13. Write the case study
14. Go through review & editing by Flo & Michelle
15. Go through NRCS review

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