Measuring environmental, social, & economic outcomes in the Upper Macoupin Creek RCPP Project (IL)

Kris Reynolds & Michelle Perez, PhD
November 8, 2018
Leadership for Midwestern Watersheds
Winona, MN
AFT Team Members

Jen Filipiak, Midwest Director
(Project lead since 2016 pre-proposal & 2014 MRBI projects)

Michelle Perez, Water Initiative Director
(MEP lead since 2016)

Kris Reynolds, Deputy Midwest Director
(Project lead since 2017)
Agenda

- Why quantify outcomes
- Water quality challenges in UMC
- UMC Partnership
- 7 goals & need for an MEP
- Environmental Outcome Methods & Results So Far
  - Monitoring outcomes
  - Modeling outcomes
  - Tracking practice outcomes
- Social Outcome Methods & Results So Far
- Economic Outcome Methods
Announcement for Public Funding for RCPP

“RCPP is an innovative approach....to design solutions and deliver specific, measurable results.”

“Through RCPP, NRCS seeks to achieve:

1. **Solutions.** Investing in projects that generate near-term results that are measurable from environmental, economic, and social perspectives.”
Why Quantifying Outcomes Matters

Farmers want to know what conservation gets them and provides to others
Watershed residents and visitors want to know they can enjoy their natural resources.
Kris’ boys enjoying a creek

Why Quantifying Outcomes Matters
Congress & the public need evidence that their taxpayer investments in conservation achieves results.

Why Quantifying Outcomes Matters
CHALLENGES IN MACOUPIN CREEK WATERSHED
Policy driver

- 2015 IL NLRS calls for a 25% reduction in TP & a 15% reduction in nitrate-N by 2025; Ultimate goal is 45% reduction for both

- We adopted the IL NLRS goals because IL does not have nutrient water quality standards for rivers
Why this watershed?

Macoupin Creek (HUC8) Watershed:

- One of 3 highest P-yielding watersheds in Illinois
- > 2 lb P/ac/yr average watershed losses
- 617,000 acres

(Source: IL NRS report. Figure 6.1)
Why this watershed?

Macoupin Creek (HUC8) Watershed:

- Not rated as a major source of nitrate-N by IL NRS report
- 5 – 9.99 lb nitrate-N/ac/yr average watershed losses

(Source: IL NRS report. Figure 6.1)
Long history of conservation in watershed

- 1994-2016: 14 EPA 319-projects
- 2003: NRCS UMC Watershed Restoration Action Strategy (WRAS)
- 2006: 3 lakes listed on IL-EPA 303d list
- 2007: TMDL Implementation Plan (lakes focused)
- Oct 2015: MRBI focused on UM Creek in 3 watersheds; Extended thru 2019
- Sep 2017: RCPP focused on MRBI + 3 adjacent watersheds; Thru 2022
Project area: 6 HUC12s within Macoupin Watershed (HUC8)
2014 MRBI & 2017 RCPP

Legend

2017 RCPP
- Bullard Lake-Middle Macoupin Creek
- Coop Branch
- Hurricane Creek

Current MRBI
- Dry Fork
- Honey Creek-Upper Macoupin Creek
- Spanish Needle Creek-Upper Macoupin Creek

Legend

- Macoupin Creek Streams
- Towns
- Highways
- Macoupin Creek Basin
- Macoupin County
- Water Monitoring Sites
FORMED THE
UPPER MACOUPIN CREEK
PARTNERSHIP
<table>
<thead>
<tr>
<th>City</th>
<th>State</th>
<th>Federal</th>
<th>Nonprofit</th>
<th>University</th>
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<td>United States Geological Survey</td>
<td>Illinois Stewardship Alliance</td>
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<td>Illinois Soybean Association</td>
<td>The Mosaic Company Foundation</td>
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<td>Macoupin County Soil &amp; Water Conservation District</td>
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<td>Macoupin County Farm Bureau</td>
<td>Walton Family Foundation</td>
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<td>Macoupin County Pork Producers</td>
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<td>CHS-Shipman</td>
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<td>Environmental Tillage Systems</td>
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<td>M&amp;M Service Company</td>
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</table>
Upper Macoupin Creek Steering Committee

- 17-members:
  - 8 farmers
  - M&M ag retailer
  - CHS ag retailer
  - NRCS-Macoupin County
  - SWCD-Macoupin County
  - AFT
SET GOALS & 
NEEDED A 
MEASUREMENT & 
EVALUATION PLAN
Goals of the UMC RCPP project

1. Improve awareness and understanding of the water quality issues in the UMC, the Illinois Nutrient Loss Reduction Strategy, the benefits of improved soil health and nutrient management
2. Increase conservation activity in the watershed by 40%
3. Improve farmer profitability
4. Reduce ephemeral gully erosion by 50%
5. No application of commercial fertilizer or manure on snow-covered or frozen ground
6. All livestock manure will be effectively stored with no potential runoff
7. Achieve a 25% reduction in total Phosphorus loads and a 15% reduction in Nitrate-N loads
Measurement and Evaluation Plan for the Upper Macoupin Creek
Regional Conservation Partnership Program Project

Version 3 – March 2018

Prepared by American Farmland Trust for sharing with the UMC Partnership on April 5, 2018

Members of the Upper Macoupin Creek Watershed Partnership

- American Farmland Trust
- Blackburn College
- CHS Shipman
- City of Gillespie
- City of Carlinville
- Environmental Tillage Systems
- Illinois Corn Growers Association
- Illinois Department of Agriculture
- Illinois Department of Natural Resources
- Illinois Environmental Protection Agency
- Illinois Stewardship Alliance
- Illinois Soybean Association
- M&M Service Company
- Macoupin County Farm Bureau
- Macoupin County Pork Producers
- Macoupin County Soil & Water Conservation District
- McKnight Foundation
- National Great Rivers Research and Education Council
- Otter Creek Quail Forever
- Precision Conservation Management
- The Mosaic Company Foundation
- USDA Natural Resources Conservation Service
- US Geological Survey
- Walton Family Foundation

- 54-pages
- Updated annually
- Table of Contents:
  - Introduction
  - Methods to measure achievement of 7 Goals
  - Next Steps
  - References
  - Tool websites
  - Appendix: 22 items
Quantifying outcomes: It’s really hard & messy

SUCCESS

WHAT PEOPLE THINK IT LOOKS LIKE

SUCCESS

WHAT IT REALLY LOOKS LIKE
ENVIRONMENTAL OUTCOMES METHODS
Monitoring Environmental Outcomes
USGS-IL is doing instream monitoring to detect improvements in UMC stream due to the project.

- Upstream-downstream streamflow gaging stations
- Weekly & storm grab samples
- Since Jul 2017
- TP, DP, DOP, SS, & nitrate + nitrite N
Instream Monitoring in 5-subwatershed by Blackburn College & IL-EPA

- In 3 MRBI watersheds (2015, red dots)
- + 2 HUC12s (2016 blue dots)
- Monthly grab samples & flow
- TP, TSS, & VSS
- Problem: Missing storms & monthly too infrequent; will explore changes
Data, data, data, can’t wait for analysis
Modeling Environmental Outcomes
Watershed & Field Modeling by Northwater Consulting

Spatial Watershed Assessment Modeling & Measurement (SWAMM) Tool

- Super-detailed landuse / landcover layer due to 5-day roadside GIS log & digitization of:
  - Each identifiable gully (12,000+), tillage, cropland, pastureland
  - Streambank erosion from road side
  - Trapping efficiency of all 1,200+ lakes, reservoirs, farm ponds & wetlands
  - Accounts for 2000+ sediment basins & other BMPs
## Watershed insights

<table>
<thead>
<tr>
<th></th>
<th>Per acre estimates</th>
<th>Total losses losses</th>
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<tr>
<td><strong>SWAMM Estimates</strong></td>
<td>1.02 lb P/ac</td>
<td>140k lb P</td>
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<tr>
<td></td>
<td>10.54 lb N/ac</td>
<td>1.4 M lb N</td>
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<tr>
<td></td>
<td></td>
<td>142k ton Sediment</td>
</tr>
<tr>
<td><strong>Back of the envelope</strong></td>
<td>&gt;2</td>
<td>170k lb P</td>
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<tr>
<td></td>
<td>5 to 10 lb N/ac</td>
<td>637k lb N</td>
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**American Farmland Trust**
Prioritization opportunities

Identified priority subwatersheds with highest loading rates:

<table>
<thead>
<tr>
<th>Subwatershed</th>
<th>lb P/ac</th>
<th>tons Sediment/ac</th>
<th>lb N/ac</th>
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<tr>
<td>Coop Branch (MRBI)</td>
<td>1.23</td>
<td>1.32</td>
<td>12.3</td>
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<td>Bullard Lake-Middle Macoupin Creek</td>
<td>1.09</td>
<td>1.23</td>
<td>9.75</td>
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<td>Spanish Needle-Upper Macoupin Creek (MRBI)</td>
<td>1.07</td>
<td>1.1</td>
<td>10.74</td>
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Field prioritization opportunities
Run “What if” scenarios with farmers & partners
Proposed Cover Crops (citizens)

Treatment Area
289.7 acres

Pollutant Loads (total annual load):

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<tr>
<th>Pollutant</th>
<th>Current Load</th>
<th>BMP reduction</th>
<th>Future Load</th>
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</thead>
<tbody>
<tr>
<td>Nitrogen (lbs/year)</td>
<td>6,404</td>
<td>1,921</td>
<td>4,483</td>
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<tr>
<td>Phosphorus (lbs/year)</td>
<td>539</td>
<td>162</td>
<td>378</td>
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<tr>
<td>Sediment (tons/year)</td>
<td>376</td>
<td>150</td>
<td>226</td>
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Pollutant Loads (per treated acre):

<table>
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<tr>
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<th>Current Load</th>
<th>BMP reduction</th>
<th>Future Load</th>
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<tr>
<td>Nitrogen (lbs/acre/year)</td>
<td>22.1</td>
<td>6.6</td>
<td>15.5</td>
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<tr>
<td>Phosphorus (lbs/acre/year)</td>
<td>1.9</td>
<td>0.6</td>
<td>1.3</td>
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<tr>
<td>Sediment (tons/acre/year)</td>
<td>1.3</td>
<td>0.5</td>
<td>0.8</td>
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Last updated by: James.Adamson
on 11/06/2017 14:59
Next up: SWAMM Interface

Watershed Dashboard

Pollutant Loading

<table>
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<tr>
<th></th>
<th>P</th>
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<tr>
<td>Land Use</td>
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X = Trans/Use/45

Progress Towards 10 Year Load Reduction Goals

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<th>S</th>
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<tr>
<td>Proposed / Planned</td>
<td>25%</td>
<td>30%</td>
<td>15%</td>
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<tr>
<td>Existing</td>
<td>1000/3500</td>
<td>2000/7000</td>
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<tr>
<td>Proposed</td>
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<td>Goal Completion Date</td>
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# of BMPs or Load Reductions Completed

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<th>Year</th>
<th>2012</th>
<th>2013</th>
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<th>2015</th>
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<td>BMPs</td>
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Proposed or Planned BMPs

<table>
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<tr>
<th>Organization</th>
<th>User</th>
<th>BMP Type</th>
<th>Load Reduction</th>
<th>Percentage</th>
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Basic map showing proposed & Constructed BMPs

SUM = XXXXXXXX

Proposed or Planned BMPs

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<th>Organization</th>
<th>User</th>
<th>BMP Type</th>
<th>Load Reduction</th>
<th>Percentage</th>
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SUM = XXXXXXXX
Next up: SWAMM Interface
Practice tracking to achieve environmental outcomes
Translating goals into trackable metrics

Goal 2: Increase conservation activity by 40%
Translation 1:
Reach 40% of farmers & landowners thru events

- 40% of 650 farmers & landowners in project area = 279
- 2.5 yrs in, 10 events = 145 unique farmers → achieved ½ goal already!

<table>
<thead>
<tr>
<th>Table 2. Outreach and Education Events for the RCPP project</th>
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<tbody>
<tr>
<td><strong>Event</strong></td>
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<tr>
<td>UMC Partnership Winter Kick-off Meeting</td>
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<tr>
<td>Soil Field Day</td>
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<tr>
<td>Soils Warrior Strip-till Meeting</td>
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<tr>
<td>CHS Cover Crops Field Day</td>
</tr>
<tr>
<td>UMC Partnerships Winter Meeting</td>
</tr>
<tr>
<td>Johnson Pork Field Day</td>
</tr>
<tr>
<td>Heyen Soil Health Field Day</td>
</tr>
<tr>
<td>Otter Lake Field Day</td>
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<tr>
<td>UMC Partnerships Winter Meeting</td>
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<tr>
<td>Phosphorus Management Workshop</td>
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Translation 2:
Get soil health practices on 40% of cropland acres

- 40% of 85,370 acres cropland in project area = 34,148 acres under CCS

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<tr>
<th>RCPP Priority Practices (units of measurement)</th>
<th>Type of practice</th>
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<tbody>
<tr>
<td>1. Cover crops (acres)</td>
<td>Conservation Cropping Systems (CCS) &amp; Soil Health Management Systems</td>
</tr>
<tr>
<td>2. Nutrient management (acres)</td>
<td></td>
</tr>
<tr>
<td>3. No till / Strip till (acres)</td>
<td></td>
</tr>
<tr>
<td>4. Grassed waterway (acres)</td>
<td>Structural Conservation Practices</td>
</tr>
<tr>
<td>5. Grade stabilization structure (number)</td>
<td></td>
</tr>
<tr>
<td>6. Water &amp; sediment control basins (WASCOBs) (number)</td>
<td></td>
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Tools in the toolbox

- $850k in RCPP EQIP & CSP FA funds earmarked for six priority practices
- $150k in RCPP technical assistance funds

<table>
<thead>
<tr>
<th>Program</th>
<th>FY18</th>
<th>FY19</th>
<th>FY20</th>
<th>FY21</th>
<th>FY22</th>
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<td>$89,410</td>
<td>$89,503</td>
<td>$63,799</td>
<td>$23,933</td>
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<td>CSP</td>
<td>$121,613</td>
<td>$123,623</td>
<td>$123,623</td>
<td>$97,991</td>
<td>$37,115</td>
<td>$503,965</td>
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<tr>
<td><strong>Total FA</strong></td>
<td><strong>$201,728</strong></td>
<td><strong>$213,033</strong></td>
<td><strong>$213,126</strong></td>
<td><strong>$161,790</strong></td>
<td><strong>$61,048</strong></td>
<td><strong>$850,725</strong></td>
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<table>
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<th>FY20</th>
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<td>$16,096</td>
<td>$16,111</td>
<td>$11,483</td>
<td>$4,308</td>
<td>$93,722</td>
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<td>CSP</td>
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<td>$9,890</td>
<td>$9,890</td>
<td>$7,839</td>
<td>$2,969</td>
<td>$55,552</td>
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<td><strong>Total TA</strong></td>
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<td><strong>$25,986</strong></td>
<td><strong>$26,001</strong></td>
<td><strong>$19,322</strong></td>
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<table>
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<th>FY19</th>
<th>FY20</th>
<th>FY21</th>
<th>FY22</th>
<th>Total</th>
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<td>FA + TA</td>
<td>$225,878</td>
<td>$239,019</td>
<td>$239,127</td>
<td>$181,112</td>
<td>$68,325</td>
<td>$999,999</td>
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</table>
3 Approaches to get to 40% of acres under soil health practices

• 40% of 85,370 cropland ac = 34,148 CCS acre goal

**Approach A: RCPP CSP** funds ~ 31,084 ac so could reach 91% of goal

• Need 15 500-ac UMC farms/yr x 5 yrs = 64 farms with CSP contracts
  • Y1 accomplishment: 11 farmers & 6,600 ac w/c is close!
  • But need CSP contracts focused on soil health practices
  • And need CSP funds to achieve new practice adoption

**Approach B: RCPP EQIP** funds ~ 5,155 ac (2,315 acres CC, 2,270 acres residue mgt/no-till, & 570 acres NMP)

→ Together = 36,239 acres or 110% of acreage goal!

*Is this do-able?*
3 Approaches to get to 40% of acres under soil health practices

- **Approach C: Ag retailer efforts**

<table>
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<tr>
<th>CHS-Shipman</th>
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<tr>
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<td>VRT</td>
<td>Soil Testing</td>
<td>Strip-Till</td>
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<td>2nd Qtr. 2017</td>
<td>4,500</td>
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<td>1st Qtr. 2018</td>
<td>5,000</td>
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<td>VRT</td>
<td>Soil Testing</td>
<td>Strip-Till</td>
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<td>1st quarter 2017</td>
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<td>3rd quarter 2017</td>
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<td>300</td>
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<td>Total for 2017 crop year</td>
<td></td>
<td></td>
<td>850</td>
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<tr>
<td>1st quarter 2018</td>
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<td>120</td>
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<td>3rd quarter 2018</td>
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<tr>
<td>Total for 2018 Crop year</td>
<td></td>
<td></td>
<td>2028</td>
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Can we get to a combined 40% no-till corn & soybean goal?
UMC project area behind state no-till soybean adoption rates

Can we get to a combined 40% no-till corn & soybean goal?
Exploring alternative practice goals

1. 40% of UMC cropland should be left undisturbed thru no-till annually

   • So 34,148 acres of 85,370 acres should be goal for no-till adoption

   • With 1% corn and 15% soybeans under no-till, 13,659 acres already under no-till so need 20,489 acres more

   • Is this do-able?
Exploring alternative practice goals

2. Reduce the 75% conventional till corn to 40% & convert remaining 60% to no-till, mulch, or reduced till

- Addresses soil & nutrient loss in fall on fragile soybean residue fields being prepped with conventional till for corn

- With 50% of cropland under corn (42,685 acres) and 75% of it (32,014 acres) under Conv Till, reducing Conv Till to just 40% means only 17,074 acres & remaining 25,611 ac shift into no-till, mulch, or reduced till

- *Is this do-able?*
If RCPP EQIP funds are insufficient....

Options for getting significant nutrient and sediment reductions:

1. Shift RCPP EQIP funds from priority structural practices to soil health practices since they have IL efficiency values & they treat the problem

2. Achieve soil health practices thru 31,084 CSP fund-able acres

3. Gain adoption of soil health practices thru 3 retailer partners

4. Gain adoption of soil health practices by leveraging PCM’s RCPP funds & incentive program in UMC project area

5. Ask farmers to adopt soil health practices on their own

*Is this do-able?*
SOCIAL OUTCOMES

METHODS
Establishing Social Indicators to Achieve Outcomes

- **Goal:** Improve awareness & understanding of water quality issues in UMC, the IL NLRS, the benefits of improved soil health & NM

- **Techniques:** in-person interviews, anonymous mailed survey, in-office handout, meeting entry & exit surveys

- We plan to track changes over time of responses to questions about the seven social factors surrounding farmer conservation practice adoption: **capacity, skills, awareness, knowledge, values, beliefs, and behaviors**
Establishing baseline metrics at the beginning of the project to compare to at the end

- **Winter 2016 Macoupin County SWCD In-Person Interview Survey** – 75 farmers within the 3 MRBI responded to Q’s about 4 social categories

- **July 2016 Bluestem Communications Group Mailed Survey** – 96 farmers within the six watershed returned anonymous survey (9.6% response rate). Same questions as in-person interview.

- **May-July 2017 Farm Service Agency In-Office Survey** – 195 farmers returned anonymous survey to FSA staff

- **January 2018 Winter Meeting Exit Survey** – 36 farmers responded to two social indicator questions in anonymous exist survey

- **August 2018 Phosphorus Management Workshop Exit Survey** – 19 farmers responded to two social indicator questions in exit survey
Data, data, hmmm

1. Awareness – Half of 195 farmers within Macoupin County (FSA survey) are aware of the IL NLRS & that Macoupin is a high P loss watershed

2. Knowledge
   • High rate of self-reported knowledge by most farmers in SWCD interview & Mailed survey) as they agreed that:
     a) their actions have an impact on water quality &
     b) using recommended practices can improve water quality
   • But Transect survey shows low usage of no till & cover crops
   • And only ¼ of FSA survey said they wanted to learn more

3. Values - Majority of SWCD (69%) & Mailed survey (71%) agreed that “protecting water quality was important even if it slows economic development”
Interesting survey effects on responses

4. Beliefs & Behaviors

• Large majorities of farmers in SWCD interview & smaller majorities in Mailed survey agreed that
  a) it was their personal responsibility to help protect water quality &
  b) they would be willing to change their management practices to improve water quality

• Aug 2018 exit survey showed
  ◆ 100% agreed “I believe the goals of the UMC Partnership are achievable if everyone does their part”
  ◆ 96% agreed “I believe it is my personal responsibility to help protect water quality through my farming decisions or the assistance to the farmers I advise”
Using social indicators to inform programming, education & outreach

5. Capacity – FSA survey identified barriers to key practices:

- Cost - Most cited barrier (33%) – associated mostly with cover crops & trapping/treating practices (e.g., bioreactors, wetlands, saturated buffers, drainage water mgt systems)

- Lacking the right equipment – 2nd most cited barrier (27%) – associated mostly with strip till and/no-till

- Not owning the land – 3rd most cited barrier (19%) – associated with filter strips and grassed waterways

- Time – 4th most cited barrier (16%) – associated with cover crops
ECONOMIC OUTCOMES METHODS
Three approaches under consideration

1. Simple economic interview of CCS-adopters in project (ex-poste):

1. Did adoption of X practice increase your profitability? (Y/N)

2. How did it increase your profitability?
   a. One or more of the following costs decreased: machinery, fertilizer, seed, herbicide, diesel, time, etc.
   b. Crop yield increased

3. Were you able to lower your N or P application rates? (Y/N)

4. If so, by how much?
Three approaches under consideration

2. Precision Conservation Management (PCM) partnership
   - Will quantify potential economic impact of tillage changes, adoption of nutrient management, and use cover crops on each farmer’s yield, profitability, and nitrogen use efficiency
   - AFT is promoting PCM to farmers to help PCM reach goal: 50 farmers in 3 counties
   - But not a project evaluation

3. New CIG project in UMC
   - Will quantify economic outcomes of 4 already successful soil health farmers using partial budgeting analysis & NRCS’s Level III T-Charts, then disseminating 2-p case studies to “soil health curious” farmers & women NOLs
   - But not a project evaluation
Why it Matters to Me
Why it Matters to Me
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