

Ecosystem Services Pilot Project



HORSE CREEK FARMER-LED WATERSHED COUNCIL

Cover crops in farming systems can provide benefits to the environment called **ecosystem services**.

Companies, corporations, and governments are looking to agriculture as a **key sector in addressing climate, habitat, soil and water resource challenges** through different ecosystem services provided by cover crops and other practices used in a regenerative farming system.

In May 2021, the Horse Creek Farmer- Led Watershed Council partnered with Polk County Land Conservation and WI DATCP to evaluate climate and water quality benefits provided by cover crops implemented on member farms. **Three farms** participated and **five fields** were evaluated overall. These farms have already been practicing long-term conservation tillage (either no-till or vertical till).

ECOSYSTEM SERVICES EVALUATED:

Soil- based greenhouse gas emissions (referred to as carbon in report). In these scenarios, this term refers to those emissions related to the interaction of fertilizer applications (i.e. any nitrous oxide emissions from N fertilizer), crop rotation sequence, and roots from crops and cover crops (i.e carbon sequestration) with the soil. This does not account for any fuel usage or impacts related to the manufacture of farm products or transport of harvested goods off the farm. This was calculated using COMET-Farm. The units of carbon dioxide equivalents (CO₂e). ***A reduction in CO₂e is desirable.***

Phosphorus loss (referred to as phosphorus in report). This refers to the amount of phosphorus loss from the field due to disturbance from tillage equipment, manure and fertilizer applications, and other field characteristics. This was calculated using SnapPlus nutrient management planning software. ***A reduction in P loss is desirable.***

Soil Erosion. This refers to the amount of soil loss from the field due to disturbance from tillage equipment, crop rotation and other field characteristics. This was calculated using SnapPlus nutrient management planning software. ***A reduction in soil erosion is desirable.***

HOW TO READ THIS REPORT:

A field report was created for each field that was evaluated containing the following information:

Carbon dioxide equivalent, or CO₂e means the number of metric tons of CO₂ emissions with the same global warming potential as one metric ton of another greenhouse gas. For example, 1 kg of N₂O into the atmosphere is about equivalent to releasing about 298 kg of CO₂. As a reference, 1 CO₂e is equivalent to 113 gallons of gasoline consumed.

Soil organic carbon content (SOC) is a measurable component of soil organic matter and represents fresh plant residues and living organisms in the soil. As a frame of reference, multiplying SOC by 1.72 gives a general estimate of soil organic matter percent. The fields in this study were sampled for SOC following a sampling protocol that generally aligned with those used in carbon markets to establish baseline SOC levels.

Tons of soil. Soil erosion is measured in tons per acre per year. As a reference, one dumptruck can carry about 10 tons of soil.

Pounds of phosphorus. P loss is measured in pounds per acre per year. As a reference, 1 pound of phosphorus that reaches a waterbody can feed 500 pounds of algae.

Potential payments were calculated to offer the farmer a means of financial comparison in entering a carbon market against federal, state and local conservation programs given the carbon outcome calculated for their particular field.

NOTE: ALL OUTCOMES IN THIS STUDY WERE ESTIMATED USING MODELING TOOLS, NOT MEASURED. ACTUAL REDUCTIONS IN GREENHOUSE GAS EMISSIONS, P LOSSES, AND SOIL EROSION MAY BE HIGHER OR LOWER.

Ecosystem Services Field Report

FIELD NAME: GATOR SITE

Management Change: Farm growing corn and soybeans started planting rye after soybean harvest. Cover crop is harvested for seed the following summer and followed with a cover crop mix. Vertical tillage is used.



CARBON

The COMET-Farm tool estimates that this field reduces soil-based greenhouse gas emissions by **37.6 carbon dioxide equivalents** (CO₂ eq).

PHOSPHORUS

Annual P loss from this field is **1.8 lbs per acre year, which is slightly lower** than without the rye + cover crop, 1.9 lb/ac/yr.

SOIL EROSION

Average sediment loss from this field is **2.4 t/ac/year** with with the rye + cover crop compared to 2.5 t/ac/year without it.

Potential Payments: Gator Site, 128 acres		
	Payment per acre	Total Payment for Field
Carbon Markets (~\$15/t/ac)	\$4.41 (0.29 t/ac)	\$564.48
EQIP (NRCS)	\$52.37	\$6,703.36
SWRM (State via County)	\$25	\$3,200.00
Horse Creek Farmer-Led Watershed Council	\$20	\$2,560.00

1.3%
ORGANIC CARBON

Field Average

= 2.2%
ORGANIC MATTER

1.2%
ORGANIC CARBON
Project Average

Decrease of

12.8
TONS

soil erosion in field



Decrease of

10LBS

phosphorus
leaving this field



Ecosystem Services Field Report

FIELD: PIVOT FIELD

Management Change: Farm growing corn and soybeans started planting rye after soybean harvest. Cover crop is harvested for seed the following summer and followed with a cover crop mix. Vertical tillage is used.



CARBON

The COMET-Farm tool estimates that this field reduces soil-based greenhouse gas emissions by **21.5 carbon dioxide equivalents** (CO₂ eq).

PHOSPHORUS

Annual P loss from this field is **0.4 lbs per acre year**, which is the same as without the rye + cover crop.

SOIL EROSION

Average sediment loss from this field is **4.3 t/ac/year** with the rye + cover crop, slightly lower than without it at 4.5 t/ac/year.

Potential Payments: Pivot Field, 66 acres		
	Payment per acre	Total Payment for Field
Carbon Markets (~\$15/t/ac)	\$4.89 (0.33 t/ac)	\$322.74
EQIP (NRCS)	\$52.37	\$3,456.42
SWRM (State via County)	\$25	\$1,650.00
Horse Creek Farmer-Led Watershed Council	\$20	\$1,320.00

1.1%
ORGANIC CARBON

Field Average

= 1.8%
ORGANIC MATTER

1.2%
ORGANIC CARBON
Project Average

Decrease of

1.2 TONS

soil erosion in field



NO CHANGE

in phosphorus leaving this field



Ecosystem Services Field Report

FIELD: FIELD 15

Management Change: Long-term no-till corn and soybean rotation started planting rye as a cover crop after soybeans. Cover crop is terminated in the spring.



CARBON

The COMET-Farm tool estimates that this field reduces soil-based greenhouse gas emissions by **5.0 carbon dioxide equivalents** (CO₂ eq).

PHOSPHORUS

Annual P loss from this field is **0.2 lbs per acre year**. There is no difference in P loss when adding rye after soybeans on this field, according to SnapPlus

SOIL EROSION

Average sediment loss from this field is **0.3 t/ac/year** with or without the rye cover crop after soybeans.

Potential Payments: Field 15, 18.4 acres		
	Payment per acre	Total Payment for Field
Carbon Markets (~\$15/t/ac)	\$4.05 (0.27 t/ac)	\$74.52
EQIP (NRCS)	\$52.37	\$963.61
SWRM (State via County)	\$25	\$460.00
Horse Creek Farmer-Led Watershed Council	\$20	\$368.00

1.1%
ORGANIC CARBON

Field Average

= 1.8%
ORGANIC MATTER

1.2%
ORGANIC CARBON

Project Average

NO CHANGE

soil erosion in field



NO CHANGE

in phosphorus leaving this field



Ecosystem Services Field Report

FIELD: FIELD 19

Management Change: Long-term no-till corn and soybean rotation started planting rye as a cover crop after soybeans. Cover crop is terminated in the spring.



CARBON

The COMET-Farm tool estimates that this field reduces soil-based greenhouse gas emissions by **5.2 carbon dioxide equivalents** (CO₂ eq).

PHOSPHORUS

Annual P loss from this field is **0.2 lbs per acre year with the rye cover crop**. There is no difference in P loss when adding rye after soybeans on this field, according to SnapPlus

SOIL EROSION

Average sediment loss from this field is **0.5 t/ac/year** with the rye cover crop compared to 0.4 t/ac/year without it.

Potential Payments: Field 19, 25.6 acres		
	Payment per acre	Total Payment for Field
Carbon Markets (~\$15/t/ac)	\$3.04 (0.20 t/ac)	\$77.82
EQIP (NRCS)	\$52.37	\$1,340.67
SWRM (State via County)	\$25	\$640.00
Horse Creek Farmer-Led Watershed Council	\$20	\$512.00

0.97%
ORGANIC CARBON

Field Average

= 1.7%
ORGANIC MATTER

1.2%
ORGANIC CARBON

Project Average

Increase of

2.6
TONS

soil erosion in field



NO CHANGE

in phosphorus leaving this field



Ecosystem Services Field Report

FIELD: MIDDLE 30

Management Change: Long-term no till corn and soybean rotation started planting rye after soybeans. Cover crop is harvested for seed the following summer and followed with a cover crop mix.



CARBON

The COMET-Farm tool estimates that this field reduces soil-based greenhouse gas emissions by **3.1 carbon dioxide equivalents** (CO₂ eq).

PHOSPHORUS

Annual P loss from this field is **0.5 lbs per acre year**. There is no difference in P loss when adding rye after soybeans on this field, according to SnapPlus.

Potential Payments: Middle 30 Field, 29 acres		
	Payment per acre	Total Payment for Field
Carbon Markets (~\$15/t/ac)	\$1.65 (0.11 t/ac)	\$47.85
EQIP (NRCS)	\$52.37	\$1,466.36
SWRM (State via County)	\$25	\$700.00
Horse Creek Farmer-Led Watershed Council	\$20	\$560.00

SOIL EROSION

Average sediment loss from this field is **1 t/ac/year** with the rye cover crop compared to 0.9 t/ac/year without it.

0.8%
ORGANIC CARBON

Field Average

= **1.4%**
ORGANIC MATTER

1.2%
ORGANIC CARBON
Project Average

Increase of
2.9 TONS

soil erosion in field



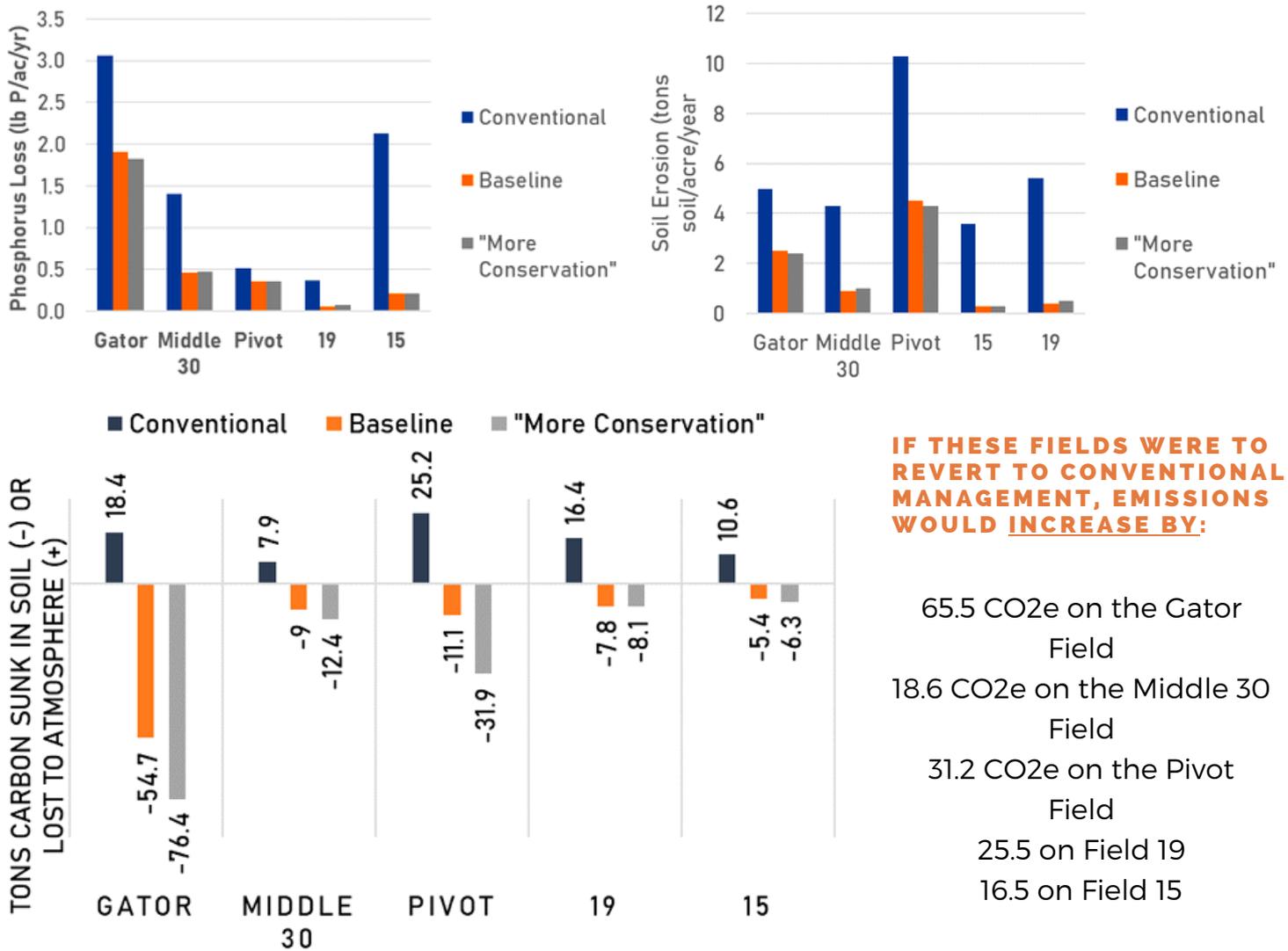
NO CHANGE

in phosphorus leaving this field



Comparison to Conventional Management Techniques

The fields evaluated in this study are already under a level of conservation, having been managed using no-till or reduced tillage for multiple years. We compared their management (baseline) and the cover crop scenario ("More Conservation") to a typical conventional management scenario for a grain system in this area to provide perspective for the value already provided by these farms.



If management of these fields reverted to conventional tillage, the potential soil erosion, phosphorus loss and soil-based greenhouse gas emissions would increase by:

157 TONS CO₂e

similar to 389,706 miles driven by a gas-powered vehicle

2.5-5.8 TONS PER ACRE PER YEAR

soil erosion



0.3-1.9 POUNDS PER ACRE PER YEAR

phosphorus loss



Summary

This study illustrated that modeling tools may show that **ecosystem service markets may not provide large financial benefit to farmers already implementing some conservation management**, due to evaluations yielding not as great of a "gain" when more conservation is introduced to the field management, compared to a field being more conventionally managed to start.

TAKEAWAYS FOR FUTURE PROJECTS:

- The outcomes modeled using project tools showed minimal reductions to phosphorus loss and soil erosion on the fields in this study.
- Farms in other parts of the state with **different field characteristics, management systems, and conservation upgrades will likely yield different results**
- While reductions to P loss, soil erosion and soil-based greenhouse gas emissions to an already established conservation system may be minimal, the cost of reverting to conventional management is **great**.
- The outcomes of these evaluations align with the critique from the conservation farming community, that carbon and ecosystem markets are not currently designed to address the benefits already provided by conservation systems.



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