

SUMMARY REPORT

DODGE COUNTY ECOSYSTEM SERVICES PILOT PROJECT



An evaluation of water quality and climate benefits provided by farms on a pilot-scale

Outcomes-based sustainability markets & programs

Companies, corporations, and governments are looking to agriculture as a key sector in addressing climate, habitat, soil and water resource challenges. There are multiple approaches to this including ecosystem service markets and performance-based conservation programs. Such approaches compensate farmers based off the outcomes provided by farming practice changes, differing from the incentive-payment based programs traditionally administered in the public sector.

Partnering with local conservation efforts

The Wisconsin Department of Agriculture, Trade & Consumer Protection's Producer-Led Watershed Protection Program, the Dodge County Land Conservation Department, and the Dodge County Farmers for Healthy Soil Healthy Water partnered to pilot an outcomes-based approach to conservation programming to evaluate the variability in outcomes across different practices and farming systems, and to determine the technical and capacity-based feasibility of such programming.

Project at a Glance:

4	participating farms	231	pounds phosphorus loss reduced
485	acres evaluated across 14 fields	209	tons soil erosion reduced
6	conservation practice changes evaluated	399	tons soil-based greenhouse gas emissions reduced



Outcomes evaluated

Soil- based greenhouse gas emissions. 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. Units are tons of carbon dioxide equivalents (CO₂e). ***A reduction in CO₂e is desirable.***

Phosphorus loss. This refers to the amount of phosphorus lost 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. Units are pounds of phosphorus. ***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. Units are tons of sediment. ***A reduction in soil erosion is desirable.***

How to read this report

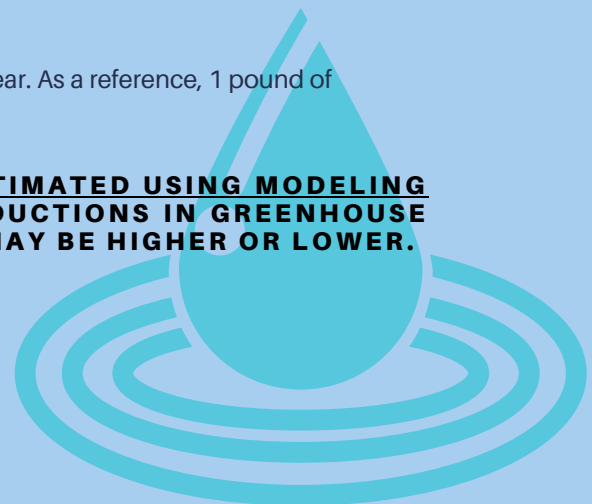
A farm report was created for the fields evaluated on each farm containing information about field histories, management changes, and the outcomes from those changes.

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.

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.

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



Ecosystem Services Report: Farm 1

Fields: Three fields; Graff South, Graff North, Heinke

Acres evaluated: 248 acres

Total P reduction: 97.5 lbs phosphorus/year

Total soil erosion reduction: 86.4 tons soil erosion/year

Total soil-based ghg emissions reductions: 111 tons CO₂e/year

Field: Graff South

Field size: 47.7 acres

Field history: Formerly a long term corn and soybeans rotation with reduced tillage (fall chisel plow, spring field cultivation). The farm operating this field is slowly transitioning to strip till on all of their fields, and used vertical tillage as an intermediate step.

Management change: Strip till corn on soybean stubble; Following corn harvest, cereal rye drilled at 1 bu/ac in fall. Soybeans planted into standing rye in spring, then restart with strip tilling soybean stubble in the fall.

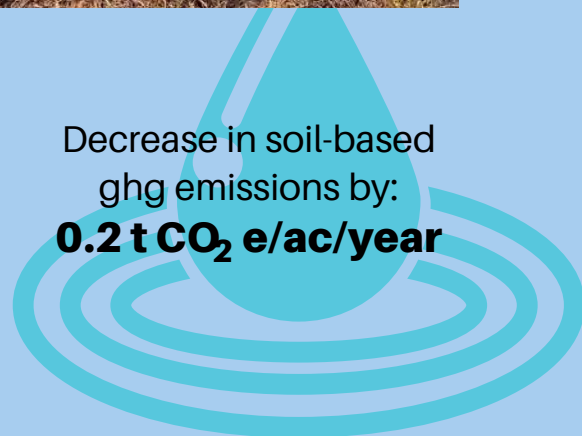


Outcomes:

Decrease in
phosphorus loss by:
0.2 lb/ac/year

Decrease in soil
erosion by:
0.1 t/ac/year

Decrease in soil-based
ghg emissions by:
0.2 t CO₂ e/ac/year



Ecosystem Services Report continued: Farm 1

Field: Graff North

Field size: 86.5 acres

Field history: Formerly under a long term corn and soybeans rotation, receiving fall chisel plow, spring field cultivation.

Management change: Strip till corn on soybean stubble; Following corn harvest, cereal rye drilled at 1 bu/ac in fall. Soybeans planted into standing rye in spring, then restart with strip tilling soybean stubble in the fall.

Outcomes:

Decrease in phosphorus loss by:
0.3 lb P/ac/year

Decrease in soil erosion by:
0.3 t/ac/year

Decrease in soil-based ghg emissions by:
0.4 t CO₂ e/ac/year

Field: Heinke

Field size: 113 acres

Field history: This field has historically always been moldboard and chisel plowed in the fall under a corn and bean rotation.

Management change: In 2021, this field started transitioning to a corn-soybean-rye cover crop strip tillage rotation.

Outcomes:

Decrease in phosphorus loss by:
0.6 lb P/ac/year

Decrease in soil erosion by:
0.5 t/ac/year

Decrease in soil-based ghg emissions by:
0.6 t CO₂ e/ac/year



Ecosystem Services Report: Farm 2

Fields: two fields; 1, 2
Acres evaluated: 51.2 acres
Total P reduction: 28.6 lbs phosphorus/year
Total soil erosion reduction: 31.2 tons soil erosion/year
Total soil-based ghg emissions reductions: 90.5 tons CO₂e/year



Farm History: The farm is a sesquicentennial farm, having been in this family for 150+ years. It is a long-term no-till corn and soybean operation, with the exception of one field that has historically been used to demonstrate antique plowing equipment.

Field: 1

Field size: 31.6 acres
Field history: Long-term no-till corn and soybeans.
Management change: Field enrolled in Conservation Reserve Program (CRP) and planted to diverse grass and forb mix in 2021.



Outcomes:

Decrease in phosphorus loss by:
0.5 lb P/ac/year

Decrease in soil erosion by:
0.7 t/ac/year

Decrease in soil-based ghg emissions by:
1.7 t CO₂ e/ac/year

Ecosystem Services Report continued: Farm 2

Field: 2

Field size: 19.6 acres

Field history: Moldboard plowed every year. Lower lying field with wet and compact soils.

Management change: Field enrolled into Conservation Reserve Program in 2021 and planted to diverse grass and forb CRP mix.



Outcomes:

Decrease in
phosphorus loss by:
0.7 lb P/ac/year

Decrease in soil
erosion by:
0.5 t/ac/year

Decrease in soil-based
ghg emissions by:
1.9 t CO₂ e/ac/year

Ecosystem Services Report: Farm 3

Fields: Seven fields; 3, 4, 9, 11, 12, M2, 25

Acres evaluated: 70.8

Total P reduction: 28.0 lbs phosphorus/year

Total soil erosion reduction: 18.2 tons soil erosion/year

Total soil-based ghg emissions reductions: 59.2 tons CO₂e/year

Fields: 3 & 4

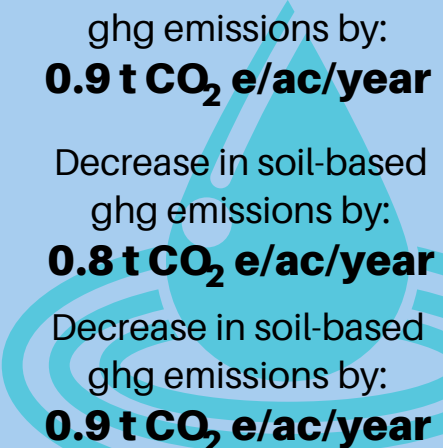
Field size: 21 acres, 20 acres

Field histories: Crop rotation of corn silage, beans, wheat and hay with mostly heavy tillage including plowing then chiseling. Fifteen years ago, this farmer started no-tilling winter wheat crop and dabbling with some cover crops.

Management change: Corn-beans-wheat rotation with cover crops. Farmer broadcasts fertilizer with rye after corn in the fall and plants soybeans into standing rye. No-till winter wheat crop follows. After wheat harvest, a cover crop cocktail mix is planted and corn crop is planted green the following spring. A portion of both of these fields were enrolled in the Conservation Reserve Enhancement Program (CREP) in 2021 where field buffers were installed near drainage ditches. CREP is a program similar to CRP where certain parts of a field are planted to a diverse perennial mix to help prevent runoff to a water source.

Outcomes:

Field 3:	Decrease in phosphorus loss by: 0.6 lb P/ac/year	Decrease in soil erosion by: 0.4 t/ac/year	Decrease in soil-based ghg emissions by: 0.9 t CO₂ e/ac/year
Field 3 CREP:	Decrease in phosphorus loss by: 0.7 lb P/ac/year	Decrease in soil erosion by: 0.4 t/ac/year	Decrease in soil-based ghg emissions by: 0.9 t CO₂ e/ac/year
Field 4:	Increase in phosphorus loss by: 0.2 lb P/ac/year	Increase in soil erosion by: 0.1 t/ac/year	Decrease in soil-based ghg emissions by: 0.8 t CO₂ e/ac/year
Field 4 CREP:	Negligible change in phosphorus loss	Negligible change in soil erosion	Decrease in soil-based ghg emissions by: 0.9 t CO₂ e/ac/year



Ecosystem Services Report continued: Farm 3

Fields: 9 & 25

Field size: 11 acres, 3 acres

Field histories: Crop rotation of corn, soybeans, and winter wheat with chisel plowing.

Management change: Rye seed is broadcast with fertilizer after corn crop comes off in the fall. Soybeans are planted into living rye the following spring. Winter wheat is planted in the fall after soybean harvest, and a cover crop cocktail is planted after winter wheat harvest. Corn is planted green into cover crop the following spring. Rotation is all no-till management.



Outcomes:

Field 9:	Decrease in phosphorus loss by: 0.1 lb P/ac/year	Decrease in soil erosion by: 0.1 t/ac/year	Decrease in soil-based ghg emissions by: 0.6 t CO₂ e/ac/year
Field 25:	Decrease in phosphorus loss by: 0.1 lb P/ac/year	Decrease in soil erosion by: 0.1 t/ac/year	Decrease in soil-based ghg emissions by: 0.6 t CO₂ e/ac/year



Ecosystem Services Report continued: Farm 3

Fields: 11, 12, M2

Field size: 1.6 acres, 1 acre, 5 acres

Field histories: Corn silage-alfalfa dairy rotation with moderate tillage.

Management change: Entire fields enrolled into Conservation Reserve Enhancement Program (CREP) in 2021 and planted to perennial diverse grass and forb mix.



Outcomes:

Field 11:	Decrease in phosphorus loss by: 0.5 lb P/ac/year	Decrease in soil erosion by: 0.1 t/ac/year	Decrease in soil-based ghg emissions by: 0.8 t CO₂ e/ac/year
Field 12:	Decrease in phosphorus loss by: 0.5lb P/ac/year	Decrease in soil erosion by: 0.3 t/ac/year	Decrease in soil-based ghg emissions by: 1.1 t CO₂ e/ac/year
Field M2:	Decrease in phosphorus loss by: 2 lb P/ac/year	Decrease in soil erosion by: 1.7 t/ac/year	Decrease in soil-based ghg emissions by: 0.7 t CO₂ e/ac/year

Ecosystem Services Report: Farm 4

Fields: Two fields; BW South, Moul

Acres evaluated: 115 acres

Total P reduction: 76.9 pounds phosphorus/year

Total soil erosion reduction: 73 tons soil erosion/year

Total soil-based ghg emissions reductions: 138 tons CO₂e/year

Field: BW South

Field size: 33 acres

Field history: This field is located next to and drains towards Beaver Dam Lake. It was formerly operated by neighbors who ran a mostly corn-on-corn rotation using the chisel plow for tillage. Over time the owner of the field noticed a lot of issues with runoff and gullies forming in the field, so they decided to seek out a different tenant. The landowner had been paying attention to the conservation practices Farm 4 had been using, so they approached them about operating this field moving forward.



Management change: Moving forward, the rotation will be two years of corn, followed by soybeans and then winter wheat. Rye cover crops are planted with an air drill after corn and bean years. A multi-species cover crop mix is planted after winter wheat, and corn and beans are planted into living cover crops in the spring.

Outcomes:

Decrease in
phosphorus loss by:
1.5 lb P/ac/year

Decrease in soil
erosion by:
1.7 t/ac/year

Decrease in soil-based
ghg emissions by:
1.5 t CO₂ e/ac/year

A decorative graphic of a water drop with ripples, located in the bottom right corner of the page.

Ecosystem Services Report continued: Farm 4

Field: Moul

Field size: 82 acres

Field history: This field is located next to Fox Lake. It had been planted to a rotation with corn, soybeans and some canning crops. Crops were chisel plowed each fall.

Management change: Rotation moving forward is three years of corn, followed by soybeans. Cereal rye is planted after each harvest, and cash crop is planted green in the spring. The whole rotation is no-till.



Outcomes:

Decrease in phosphorus loss by:
0.3 lb P/ac/year

Decrease in soil erosion by:
0.2 t/ac/year

Decrease in soil-based ghg emissions by:
1.1 t CO₂ e/ac/year



SUMMARY

The results of this project indicate a wide range in outcomes:

- An increase of phosphorus loss of 0.2 lb/P/ac/yr to a decrease in loss of 2 lb/P/ac/yr
- An increase in soil erosion of 0.1 t/ac/year to reduction of 1.7 t/ac/year
- A range of reduced soil-based ghg emissions from 0.2 t CO₂e/ac/year to 1.9 t CO₂e/ac/year

The outcomes for each field are dependent upon a variety of factors including soil type, slope, crop rotation, but most importantly **land management changes**. The greatest outcomes in this project occurred with Farm 4 where a field with with historically aggressive management is under transition to less tillage and a more diversified rotation with cover crops. Farm 3's field planted to a diverse perennial mix for enrollment into CREP yielded the next highest outcomes.

The table below summarizes what each farm received as a payment for the outcomes of management changes made. Farmers were paid using a payment structure of \$12/ton CO₂e reduced and \$25/lb P reduced.

Summary table of outcomes and payments:

Farm	Field Name	Acres	Carbon (ghg) Reduction	Carbon (ghg) Payment	P Reduction	P Payment	Combined Payments
Farm 1	Graff North	86.5	32.7		22.9		
	Graff South	47.7	10.2		7.2		
	Heinke Big	113.3	68.1		67.4		
	Total for farm	247.5	111	\$1,332.00	97.5	\$2,437.24	\$3,769.24
Farm 2	1	31.6	53.3		15.0		
	2	19.6	37.2		13.7		
	Total for farm	51.2	90.5	\$1,086.00	28.6	\$715.86	\$1,801.86
Farm 3	3	15.4	14.4		9.9		
	3CREP	5.6	5		3.8		
	4	14	11.4		-2.5		
	4CREP	6	5.3		0.1		
	9	11.1	7		0.9		
	11	3.3	2.5		1.7		
	12	7.2	8.2		3.7		
	M2	5.2	3.7		10.3		
	25	3	1.7		0.2		
Total for farm	70.8	59.2	\$710.40	28.0	\$700.77	\$1,411.17	
Farm 4	BW South	33	50.9		49.4		
	Moul	82	87.2		27.5		
	Total for farm	115	138.1	\$1,656.00	76.9	\$1,922.19	\$3,578.19
Project Totals:		484.5 acres	399 tons CO₂e	\$4,784.40	231 lb P	\$5,776.06	\$10,560.46

Thank you to the participating farmers in this project and to all of the farmers working to build soil health and improve water quality in Dodge County!



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