Peninsula Pride Farms Sustainability Project Three-Year Progress Report (2020-22)

July 2023

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1 EXECUTIVE SUMMARY

Farmers for Sustainable Food and Peninsula Pride Farms have worked together since 2020 to create a baseline set of information for seven core sustainability metrics from a widely accepted industry leader in the space, Field to Market: The Alliance for Sustainable Agriculture™. Additionally, PPF was interested in how their farmer members were impacting local water resources and worked with FSF and Houston Engineering, Inc., to identify how current and future in-field best management practices are influencing changes to local water resources.

Founded in 2016, Peninsula Pride Farms is a group of farmers and businesses focused on improving the environment and ensuring sustainable farming into the future. Part of this commitment led PPF to start an Innovation Project within Field to Market's Continuous Improvement Accelerator program. Quantifying and measuring environmental metrics that are nationally recognized aligns with PPF's mission statement: "As farmers and caretakers of the environment, we are committed to protecting, nurturing and sustaining our precious soil, water and air. To foster environmental stewardship, we will promote practices with measurable outcomes that secure and enrich the future of our shared community."

Farmer Participation:

- ***Door and Kewaunee Counites in Wisconsin***
- ***11 farms that manage over 34,000 acres are evaluating on-farm sustainability metrics***
- ***Combined dairy cattle headcount of over 40,000***

This report summarizes three years year of data collection and analysis (2020-2022 crop years) involving 11 PPF farmers from Door and Kewaunee Counties in Wisconsin. These 11 farmers worked to obtain environmental information regarding their farming footprint on greenhouse gas emissions, water quality, soil erosion and energy efficiencies.

Tools used in the project to evaluate on-farm crop enterprise sustainability and local water quality included:

- On-farm sustainability – Field to Market's Fieldprint Platform™
- Local water resources – Prioritize, Target, and Measure Application (PTMApp), Minnesota Board of Water and Soil Resources.

Biodiversity	Energy Use	Greenhouse Gas	Land Use Efficiency	Soil Carbon	Soil Conservation	Water Quality

Key Project Purposes

1. Assess if current farming practices in conservation-conscious areas are having a positive impact on sustainability and water quality compared to the Fieldprint Platform's national indicators and state benchmarks.
2. Increase the use of sustainability measurement platforms by farmers to inform land and water management decisions, leading to increased adoption of conservation measures.
3. Identify area within the watershed to improve nutrient management to protect groundwater resources.

KEY FINDINGS AVERAGE OF THREE-YEAR PERIOD

Conservation Practices	Water Quality	Soil Erosion	Energy Use	Greenhouse Gas Emissions
On average, farms use two or more conservation practices.	91% of reported acreage has mitigated the risk of excessive loss of nitrogen to subsurface	1.0 tons/acre/year compared to state benchmark* of 3.5 tons/acres/year for corn grain.	166,432 btu/ton for corn silage, 47% lower/better than national indicator.	87 lbs CO2e/ton Four percent higher/worse than the corn silage state benchmark*

*Field to Market's state benchmark for Wisconsin.

KEY FINDINGS ANNUALIZED RATE OF CHANGE OF METRICS OVER THREE YEARS

Conservation Practices	Water Quality Score	Soil Erosion	Energy Use	Greenhouse Gas Emission
No change	Alfalfa: No change Corn Silage: No change Corn Grain: 12% worsening	Alfalfa: No change Corn Silage: No change Corn Grain: 44% worsening	Alfalfa: 8% improved Corn Silage: No change Corn Grain: 5% improved	Alfalfa: 9% improved Corn Silage: No change Corn Grain: 8% improved

*No change indicates a less than 5% change in either direction on an annualized basis. Because the dataset is only showing three years of data and sampled fields are 10% of total farmed area, the 5% cutoff was chosen to reduce overall statistical noise within the data.

KEY FINDINGS FROM WATER QUALITY ASSESSMENT

The Prioritize, Target, and Measure Application was used to estimate the field edge load reductions for sediment, phosphorus, and nitrogen from fields that have installed conservation practices within the project area. The values are based on the cumulative acreage and estimated average reduction benefit of best management practices that were reported in the 2022-member conservation practice survey of Peninsula Pride Farms. Load reductions are estimated individually for each BMP and, in this project, do not take into consideration the effects that overlapping or upstream BMPs may have on load reduction estimates. Reduction estimates are based on modeled current loading losses from the watershed from PTMApp. Current loading assumes that no BMPs are on the landscape.

154,000 acres of BMPs in watershed are reducing field edge losses by:

148,000 tons of sediment	**21,500 lbs of phosphorus**	**373,000 lbs of nitrogen**

BMPs used in calculation: cover crops, no-tillage, reduced tillage and nutrient management.

2 SUSTAINABILITY METRIC METHODOLOGY

An explanation of the Field to Market Fieldprint Platform metrics can be found on their website, fieldtomarket.org/ourprograms/sustainability-metrics. A breakdown of four metrics (energy use, soil erosion, greenhouse gas emissions, and water quality) highlighted throughout this report is provided in the Year 1 report which is available on the Farmers for Sustainable Food website.

2.1 PROJECT-BASED RESULT METHODOLOGY

All data within the report was obtained from Field to Market's downloadable data (comprehensive data output file), the 2020 National Indicators Report (Field to Market, 2021) and Field to Market's national and state benchmarks.

National indicators, retrieved from the National Indicators Report, and state and national benchmarks are reference points meant to provide context for Fieldprint results. These indicators and benchmarks were calculated based on USDA Survey and Census data for prior years and thus represent a historical point of reference but do not provide a starting point for measuring continuous improvement. Project benchmarks in this report are reported for a three-year growing period (2020-2022) and calculated with actual farmer data.

In instances where a project benchmark is broken down and discussed more granularly (Section 6), the comprehensive data output file was used to obtain the breakouts. For instance, the water quality metric is broken out by water quality pathways to provide a deeper insight into water quality mitigation occurring as well as opportunities for improvement. All water quality breakout scores are weighted by field size to better reflect the total area of the project meeting or not meeting mitigation thresholds. Data is screened to ensure complete data is present before analysis is completed. Project benchmarks were created for alfalfa, corn silage and corn grain. Project benchmarks were weighted by field size or by production (bu/tons) where appropriate.

Total best management practices implemented within the project can be located within the comprehensive data output file. Best management practices are self-reported and are only as accurate as the data entered into the platform. For this report, all BMPs for the three years of the project were summed up by year to determine the total number of active BMPs during each growing season. To get the average active BMPs per field per year, the total BMP count (which includes all BMPs from the 'water conservation practices' column and the total number of fields actively using cover crops in the growing year) was divided by the total number of fields within the project during each growing season. If "no-tillage" and "reduced tillage" were both selected during data entry, only one was counted as to not double count practices.

3 ON-FARM CROP ENTERPRISE SUSTAINABILITY

Using Field to Market's Fieldprint Platform™, seven of the eight possible on-farm sustainability metrics were measured for each project farm. The irrigation metric was not applicable to this project. The metrics use actual farm data collected from each farm for each year analyzed. Data can be presented at the field level, farm level and project level. Comparison metrics between anonymized project participants and state and national benchmarks and indicators can be used to gauge how well each farmer is doing within the group. The Fieldprint Platform is designed to provide insights into 1) eight sustainability metrics, seven of which were utilized for this project, 2) how on-farm operations and management affect scores, 3) ability to compare individual scores against project, state and national benchmark scores, as well as national indicators and 4) evaluate and identify ways to improve scores. The Fieldprint Platform, as an on-farm sustainability tool, can be used to quantify and measure farm and a sustainability project's pursuit of continuous improvement over time (Field to Market, n.d.).

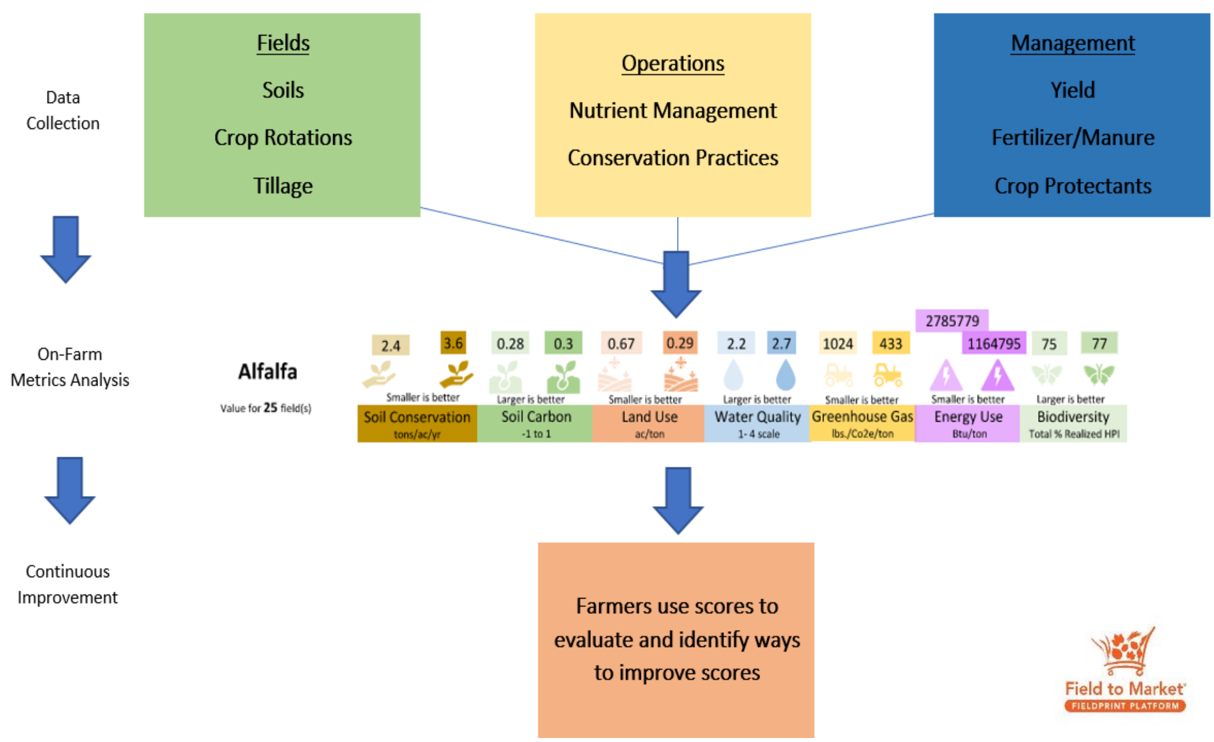


Figure 1: On-farm sustainability continuous improvement model. Data in figure is a visual representation only and does not represent any project specific scores.

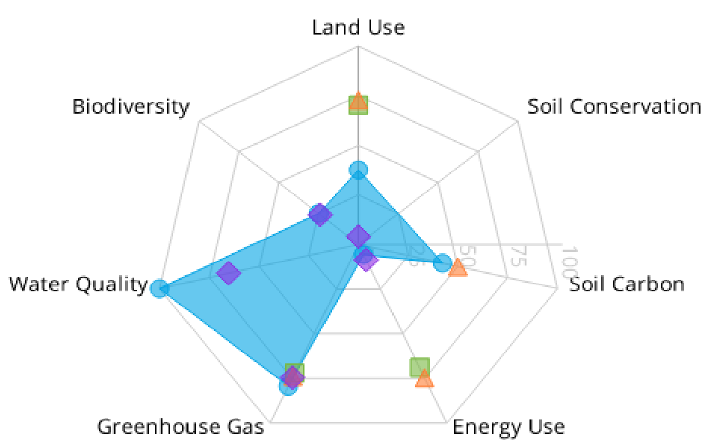
4 PROJECT RESULTS (2020-2022 GROWING SEASONS)

Field and farm level – Each farm receives a detailed Fieldprint Platform report for each field entered into the platform (Figure 2). The number of fields vary based on the crops grown and acres planted. Individual field data is treated under a strict confidentiality agreement and is only shared with farmer permission or when it is aggregated and anonymized. An example report for corn silage is shown in Figure 2. Each report shows how individual scores compare against project, state and national benchmarks, which gives the farmer insight into their farming operation and areas where they may want to investigate to make improvements.

Project benchmarks are a useful way to show a farmer how their individual scores compare to those of others enrolled in the project as well as at the state and national levels (Figure 2). They can also be useful for a farmer-led watershed conservation group to set goals and strive for improvement over time. At the project level, results are aggregated and anonymized.

Fieldprint Result

Fieldprint results are shown on the spidergram as relative indices on a scale of 1-100 that represent your metric scores. The indices are calculated so that smaller values indicate less resource use or environmental impact from your field. This illustration can be used to identify where the greatest opportunities for improvement are for your field, and over time can be used to evaluate progress and trade-offs between different sustainability metrics for your field.



Metric	Your Result	Project Benchmark	State Benchmark	National Benchmark
Land Use (acre / ton)	0.049	0.0382	0.0582	0.0592
Soil Conservation (ton / acre / year)	3.1	3	N/A	N/A
Soil Carbon	0.15	N/A	N/A	0
Energy Use (btu / ton)	109,204	119,343	242,976	268,076
Greenhouse Gas (lbs-CO_2e / ton)	96.9	87.9	83.2	86.8
Water Quality	0	1.39	N/A	N/A
Biodiversity	75%	76%	N/A	N/A

The Water Quality score here indicates how many of the four loss pathways have been mitigated. For more detail on each metric score please refer to the individual metric output. Benchmarks represent an average based on USDA statistical data for the period 2008-2012 and provide context for how your scores relate to this known point. Benchmarks should not be interpreted as a specific level of sustainability, or a performance target. State and National benchmarks that are not shown in the table or on the spidergram are not available for the applicable metric. Project benchmarks represent the average performance across fields enrolled in the Lafayette Ag Stewardship Alliance Project.

Figure 2: UW-Platteville Pioneer Farm 2021 corn silage Fieldprint Platform footprint results

Table 1: PPF Fieldprint Platform project sustainability metrics for the three growing seasons of the project (2020-2022). Data from Fieldprint Platform comprehensive data output file.

Field Level Fieldprint Platform Output			
Table 1 contains the PPF project benchmarks for corn grain, corn silage and alfalfa based on 11 farms for three years of the project.	**Corn Grain**	**Corn Silage**	**Alfalfa**
Soil Conservation*	………………… ton/ac/yr …………………		
	1.01	1.31	1.34
Energy Use**	… btu/bu …	…………….. btu/ton ……………..	
	31,293	165,108	1,307,312
Greenhouse Gas**	lbs. CO_2e/bu	lbs. CO_2e/ton	
	16.2	86.9	555.2
Water Quality*	……………………. unitless ………………………		
	1.84	2.71	3.09
Biodiversity*	………………………… % …………………………		
	71.0	79.2	77.4
Land Use**	….ac/bu….	……………..ac/ton……………..	
	0.0063	0.050	0.430

*Weighted average by area (field sizes)

**Weighted average by production (yields)

State benchmarks and national indicators – The project partners and interested farmers can compare metrics to national indicators and state benchmarks to better understand how the project performs against national and state averages. Field to Market has published updated national indicator metrics for 2020 (FTM, 2021). State benchmarks are averages from data between 2008-2012. The comparisons are listed in Table 2.

Table 2: State Benchmarks and National Indicators vs project benchmarks by crop type

		Corn Grain	Corn Silage	Alfalfa
Soil Conservation		………………………… tons/ac/yr		……………………………
	Project	1.01	1.31	1.34
	State Benchmark	3.5	N/A	N/A
	National indicator	4.7	4.7	NA
Energy Use		……… btu/bu ………	……… btu/ton ………	
	Project	31,293	165,108	1,307,312
	State Benchmark	25,291	242,976	N/A
	National indicator	37,791	312,716	NA
Greenhouse Gas		lbs. CO_2e/bu	lbs. CO_2e/ton	
	Project	16.2	86.9	555.2
	State Benchmark	9.3	83.2	N/A
	National indicator	10.7	122.2	N/A
Land Use		…ac/bu…	………………..ac/ton………………	
	Project	0.0063	0.050	0.430
	State Benchmark	0.0069	0.0582	N/A
	National indicator	0.0058	0.0493	N/A

Table 2 shows that the PPF group is, on average, performing better against the state benchmarks and national indicators in soil conservation. The group is performing better than the state benchmark and national indicator for energy use in corn silage. For corn grain, the project participants are consuming 24% more energy per bushel of corn grain compared to the state benchmark but performing 17% better compared to the national indicator. The group is producing higher greenhouse gases when compared against the state benchmark and national indicator for corn grain.

In instances where there is an 'N/A' present, state benchmarks and/or national indicators cannot be created yet due to the lack of information from USDA on crops and or regions.

5 THREE YEAR PROGRESS BY METRIC

This section of the report provides a description of what each metric is measured by (units) and how it is measured. Each metric defines if a better score is one that has decreased or increased over time. The metrics show the annualized percent improvement over the three years of the project. This annualized rate of change can be used to understand the general direction per crop per year. For example, alfalfa soil conservation score has decreased on average, by 2% per year, suggesting that there has been less soil erosion on alfalfa fields since 2020.

Values that are considered "no change" are values that had an annualized rate of change of less than 5 percent in either direction. Because datasets are still only showing three years of consecutive data and sample only 10% of the crop fields of the given cropped area, incremental changes may be harder to interpret with the available data. The same can be said for small sample size areas and fields that show a high annualized rate of change. Corn grain specifically has a low sample acreage due to the small number of farmers who planted corn grain and involved in the project. Because of the small total acreage of corn grain and the inconsistency of having the same fields in each year for corn grain, the changes for corn grain can be large in either direction (negative or positive). In all cases, referring to the numeric value of the score (Table 1 and Table 2) can help contextualize the annualized percentage change. As an example, the annualized rate of change for corn grain of 44%, is large. However, the soil loss for corn grain is only 1.0 tons/ac/yr, significantly below the state benchmark soil loss for corn grain, which is 3.5 tons/ac/yr.

Soil Conservation

Alfalfa: No change

Corn Silage: No change

Corn Grain: 44% increase

A decreasing percent is preferred.
Annualized rate of change

unit of measure: tons of soil lost per acre per year (tons/ac/yr)

measurement explanation:

Soil erosion is calculated from the USDA NRCS erosion models (WEPP and WEPS). A smaller value is better because that means less soil is leaving the fields each year.

Soil Carbon

Alfalfa: No change

Corn Silage: No change

Corn Grain: -15%

An increasing percent is preferred.
Annualized rate of change

unit of measure: Unitless; scored between -1 and 1. A value greater that 0 suggests soil carbon is increasing while a value less than 0 suggests soil carbon is being lost.

measurement explanation:

Soil carbon is calculated using the Soil Conditioning Index developed by the NRCS. The value of the soil carbon score shows the likelihood that carbon is either getting stored or is being lost. A larger or smaller score does not suggest how quickly soil carbon is being gained or lost.

Water Quality

Alfalfa: No change
Corn Silage: No change
Corn Grain: -12%

An increasing percent is preferred.
Annualized rate of change

unit of measure: Scored between 1 to 4. Score breakdown is described in previous section.

measurement explanation:

The water quality metric is comprised of four pathway mitigation processes: surface phosphorus pathway, subsurface phosphorus pathway, surface nitrogen pathway, and subsurface nitrogen pathway. A larger value is preferred as it shows that more pathways were mitigated (i.e., lower risk of nutrients leaving the field from the surface [runoff] and/or subsurface [leaching]).

Energy Use

Alfalfa: -8%
Corn Silage: No change
Corn Grain: -5%

A decreasing percent is preferred.
Annualized rate of change

unit of measure: British thermal units per acre (BTU/ac)

measurement explanation:

Energy use is calculated from the point of pre-planting all the way to the first point of sale. This metric tries to consider all energy that went into creating the product. Energy use touches all parts of the platform from field location, soil type, crop rotation, management, and drying. An example of how to interpret BTU consumption: A house in the United States in 2020, on average, consumed nearly 11,000 kilowatt hours of energy, or approximately 37.5 million BTUs of energy.

Greenhouse Gas Equivalent

Alfalfa: -9%
Corn Silage: No Change
Corn Grain: -8%

A decreasing percent is preferred.
Annualized rate of change

unit of measure: Pounds of carbon dioxide and carbon dioxide equivalents produced per acre

measurement explanation:

Greenhouse gas equivalents include carbon dioxide (CO_2), and nitrous oxide (N_2O) emissions. This equivalent simply converts nitrous oxide emissions into carbon dioxide emissions so that the values can be compared with one another.

Land Use

Alfalfa: -7%
Corn Silage: No change
Corn Grain: No change

A decreasing percent is preferred.
Annualized rate of change

unit of measure: acres per ton or acres per bushel of production

measurement explanation:

The land use metric shows how much land is needed to produce one ton or bushel of product. A smaller value is preferred as it shows that more product is being created per acre of land in production.

Biodiversity Score

Alfalfa: No change
Corn Silage: No change
Corn Grain: No change

An increasing percent is preferred.
Annualized rate of change

unit of measure: Habitat Potential Index (HPI) expressed as a percent. A value provided to each field of the potential of a given farm to provide wildlife habitat on land or in water within the field boundary.

measurement explanation:

Biodiversity metric has two parts to it. The HPI score is a value, and the biodiversity score is a percent which shows the amount of habitat the field provides based on the field's potential biodiversity estimate.

6 FIELDPRINT WATER QUALITY METRIC

Water quality is the priority resource concern in the region and project area due to areas of high nitrate in groundwater and proximity to Lake Michigan. Excess sediment, phosphorus and nitrogen can result in impairment to fish and wildlife habitat and drinking water. The Fieldprint Platform uses USDA's Stewardship Tool for Environmental Performance to assess how likely a field is to lose nutrients to waterways and subsurface water. Based on soil properties and local climate characteristics, STEP assigns a Field Sensitivity Score to each field that represents the potential for nutrient losses, either by runoff beyond the edge of the field (surface loss) or leaching below the rootzone (subsurface loss), for each of four loss pathways: surface P (Phosphorus), subsurface P, surface N (Nitrogen), and subsurface N. STEP then assigns mitigation points for management practices that impact nutrient loss (a Risk Mitigation Score (RMS)).

A score of 1 or above means a farmer has mitigated the risk of excessive nutrient loss to the environment for a pathway.

The final metric score for each nutrient loss pathway is a ratio of how effective management practices are at mitigating the risk of nutrient loss (RMS) to how sensitive the field is to nutrient loss based (Field Sensitivity Score (FSS)). If the ratio is 1 or higher, the basic level of risk mitigation for excessive nutrient loss has been met. If the ratio is below 1, excessive nutrient loss is likely, and producers should discuss potential mitigation practices with their advisors.

Water Quality Score

unit of measure: Scored between 0 and 4.

numeric score across project years: 2.80 unitless

The water quality metric is comprised of four pathway mitigation processes: surface phosphorus pathway, subsurface phosphorus pathway, surface nitrogen pathway and subsurface nitrogen pathway. A larger value is preferred (maximum score of 4) as it shows that more pathways were mitigated (i.e., fewer nutrients were able to leave the field from the surface and/or subsurface). This score is representative of all crops grown.

Figure 3: Water quality score and explanation. PPF 2020 crop year water quality score.

The aggregated score for the PPF project is 2.80 out of 4 (weighted by field size and when all fields regardless of crop are aggregated together), suggesting that on average, each of the 11 farmers is mitigating between two and three pathways. A breakdown of each nutrient loss mitigation pathway is provided in Table 3. The water quality score, 2.80, differs from what is seen in Table 1 because the value represents the entire project, not a specific crop.

Table 3: Water quality loss pathway explanation.

	Loss Pathway	
	Phosphorus	**Nitrogen**
Surface Pathway Mitigation	**82% of project acres mitigated excessive risk of surface phosphorus losses.**	**93% of project acres mitigated excessive risk of surface nitrogen losses.**
Subsurface Pathway Mitigation	**23% of project acres mitigated excessive risk of subsurface phosphorus losses.**	**83% of project acres mitigated excessive risk of subsurface nitrogen losses.**

Table 3 outlines the different phosphorus and nitrogen loss pathways that are calculated with the Fieldprint Platform and the results from the project for the duration of the project.

Figure 4 outlines the different pathways that are mitigated within the PPF project. This figure provides a breakdown of Table 3 by year to show how mitigation pathway acres have changed over time. It is important to note that fields change from year to year, so the change in the water quality breakdown where scores change does not necessarily mean that fields that were mitigating a pathway in one year are suddenly not mitigating pathways in the next year. It is possible that fields were not counted in the next year because they were growing a crop that was different from alfalfa, corn silage or corn grain.

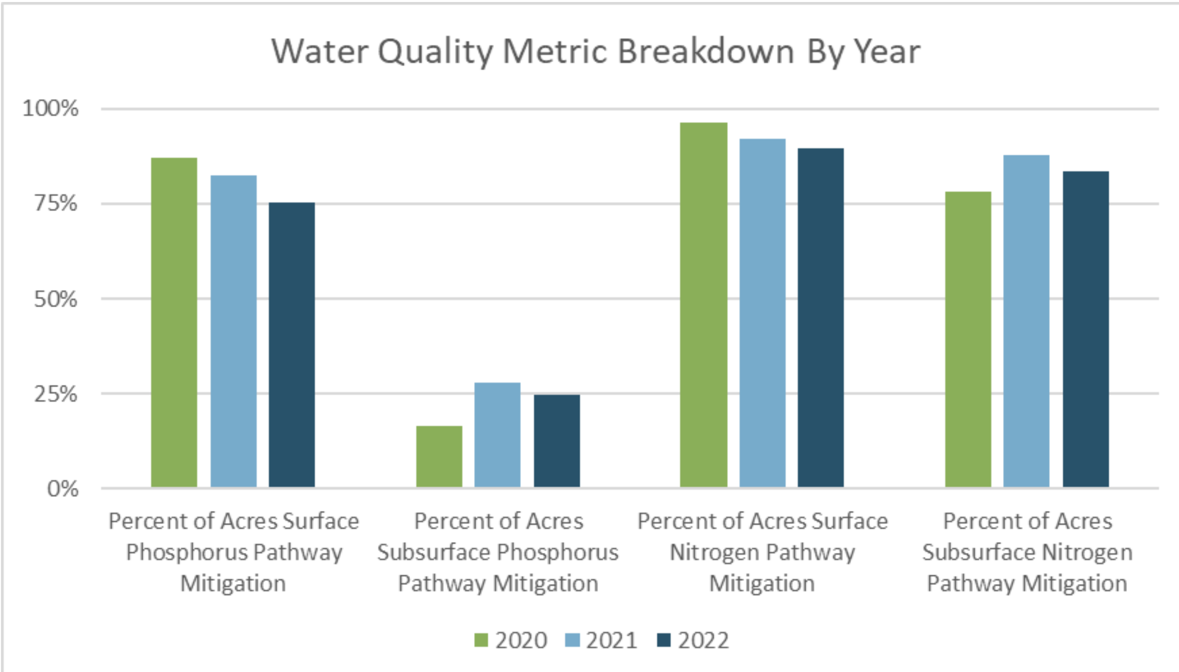


Figure 4: Water quality metric breakdown for the three-year project period. Pathway mitigation percentages show the percentage of acres within the project that have mitigated pathways.

ADOPTION OF CONSERVATION PRACTICES

The use of conservation practices greatly influences farm field water runoff and the soil and nutrients that it carries. Conservation practices are designed to reduce water runoff and loss of sediment, phosphorus and nitrogen by reducing water and wind erosion and precision application of crop fertilizers, including manure. Common conservation practices used by farmers in Peninsula Pride Farms are:

- No-till or reduced tillage
- Cover crops, including planting green
- Grassed waterways
- Farming on the contour
- Harvestable buffers
- Low disturbance injection of manure
- Comprehensive nutrient management
- Drainage water management

On average, there are more than two conservation practices on each of the enrolled fields.

Farms using the Fieldprint Platform self-report conservation practices that are implemented on each field within the platform. Across the 11 farms, there was a range between 0 and 7 conservation practices on a given field, with an average of 2.7 BMPs per field. The top four practices used within the PPF project are reduced tillage, cover crop, no-till, and grassed waterways.

7 LOCAL WATER RESOURCES/WATER QUALITY

As part of PPF's vision for clean, safe water and a thriving agricultural community together on the Door-Kewaunee Peninsula, the Board of Directors, as part of this project, desires to learn more about the impact of farming on local water resources, either positively or negatively. This project selected to use the PTMApp tool to establish:

1. An understanding of where loss of sediment, phosphorus and nitrogen to surface water are occurring in the project area,
2. Developing a nitrogen risk infiltration assessment,
3. Estimating the impact of conservation practices reported on fields enrolled in the Fieldprint Platform to see what the impact of adopted conservations are,
4. Assess where and if enrolled fields are mitigating for excessive loss of nitrogen to subsurface water, and
5. Develop targeted implementation scenarios to demonstrate impact and help refine PPF cost-share and outreach programs.

The Year 1 Report for Peninsula Pride discusses the nitrogen infiltration risk assessment map in greater detail. The following discussion will focus on the results of goals three, four and five listed above. To estimate the impacts of current and future best management practices, a baseline of data about the loss of sediment, phosphorus and nitrogen must be determined. PTMApp determines a baseline of these losses by assuming no best management practices are currently on the landscape. Baseline values are estimated using the Revised Universal Soil Loss Equation for sediment, and literature values for estimate nitrogen and phosphorus yield losses based on land use types. Additional information on this methodology can be found at the Minnesota Board of Soil and Water Resources website.

The PTMApp tool was used to evaluate the effectiveness of local conservation projects for reducing sediment, nitrogen and phosphorus delivered to local rivers and lakes. This information can help create better dialogue around agriculture and water quality issues as well as target outreach, technical assistance and financial assistance to those farms and fields where adoption of CPs and BMPs will produce cost-effective land treatment.

In a separate project, the Lafayette Ag Stewardship Alliance also completed a local water resources project using the PTMApp tool. Year One's report provides an extensive review of how PTMApp was used and is used within the PPF project. That report can be accessed at Farmers for Sustainable Food's website.

7.1 ESTIMATING THE IMPACT OF CONSERVATION PRACTICES FROM PENINSULA PRIDE FARMS THROUGH PTMAPP

Using the self-reported best management practices from Fieldprint Platform, PTMApp was cross-referenced to come up with list of BMPs that could be used to estimate practice benefits. This was a necessary step because not all practices within Fieldprint Platform and PTMApp are the same. The reported practices in the Fieldprint Platform that overlapped with the available PTMApp practices were cover crops, no-tillage, reduced-tillage and nutrient management.

An analysis was performed to determine the best fit equations based on acreage for the four conservation practices. These equations enable the Peninsula Pride Farms group to estimate the average reduction benefit for sediment, phosphorus and nitrogen for each additional acre of management practice implemented. The best fit analysis was conducted across the watershed area and actual best management practice reduction results will vary.

The best fit equations were applied to the 2022 Peninsula Pride Farms member conservation practice survey to determine the estimated benefits from acres of conservation practices that were implemented across the watershed area within the four BMP categories. The best fit equation results show the median estimated reduction benefit. Load reductions are estimated individually for each BMP and, in this project, do not take into consideration the effects that overlapping or upstream BMPs may have on load reduction estimates.

The result of this analysis showed that there were 153,000 acres of BMPs reported on the survey that were: cover crops, no-tillage, reduced-tillage or nutrient management. PTMApp estimates that the reduction estimates from these BMPs are 148,000 tons of sediment, 21,500 lbs of phosphorus and 373,000 lbs of nitrogen at field edge.

153,000 acres of BMP in watershed are reducing field edge losses by:

148,000 tons of sediment	21,500 lbs of phosphorus	373,000 lbs of nitrogen

7.2 TWO SUBWATERSHED ASSESSMENTS

The Ahnapee River watershed and the East Twin River watershed were run through an analysis within PTMApp to identify the current reduction benefits from currently installed BMPs at both the field edge and at the watershed outlet. These watershed assessments have some assumptions that go into the model:

1. Only fields within Fieldprint Platform that are within the subwatershed drainage areas were considered in the assessments.
2. Only fields that were of low or moderate nitrogen infiltration risk were assumed to have field runoff reaching the watershed outlet point.
3. Downstream watershed benefits were estimated based on the subwatershed size and not specific to individual fields.

4. BMPs used in the analysis were cover crop, no-tillage, reduced-tillage and nutrient management. It was assumed that if any of the above BMPs were used on the field, the entire field was put under this best management practice.
    a. If both no-tillage and reduced tillage was reported as being used on the same field, no-tillage was used.

7.2.1 EAST TWIN RIVER

There were a total of 769 field acres within the East Twin River from participating farms for this analysis, or approximately 2% of the entire contributing drainage area of East Twin River outlet.

Using the same approach as was used for estimating best management practice reduction benefits by using the best fit equations for the entire watershed, new best fit equations were created specifically for this subwatershed to provide a more accurate representation of reduction values for this subwatershed.

The BMPs employed within the watershed are estimated to be preventing the loss of 1,980 tons of field edge sediment per year, or an estimated 4.4% of sediment that is modeled to be lost to field edge each year within the East Twin Rivers subwatershed. The same 769 field acres are stopping an estimate 133 lbs, or 1.6% of phosphorus that would have otherwise been lost at the field edge if best management practices were not in place.

Due to the topography and known karst and sinkhole areas within the region, not all field runoff is expected to get to the watershed outlet. By using the best publicly available data, it is estimated that 654 of the 769 field acres in this study had the ability to have runoff reach the watershed outlet. Using the same BMPs as in the field edge reductions above, the BMPs are reducing the amount of sediment and phosphorus from leaving the watershed by 1.6% and 1.3% respectively.

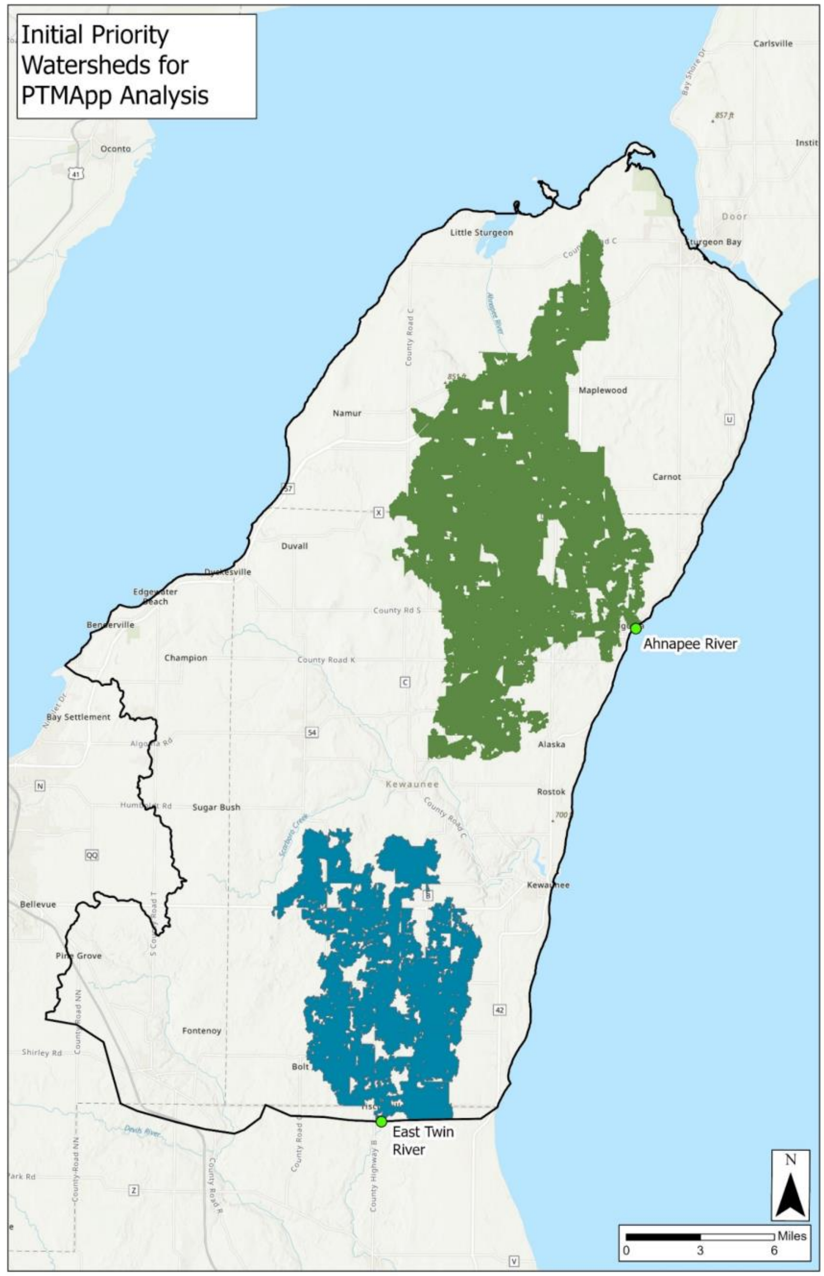


Figure 5: Subwatershed locations

> **The project fields in the East Twin River subwatershed are helping reduce sediment and phosphorus lost to the outlet by 1.6% and 1.3% respectively.**

7.2.2 AHNAPEE RIVER

Ahnapee River had the same analysis completed as the East Twin River watershed (Section 7.2.1).

83% of Fieldprint Platform field acreage have mitigated excessive loss of nitrogen to subsurface water from adoption of conservation

The analysis was performed using Fieldprint Platform fields which had a total area of 1,420 acres regardless of if they were contributing to the watershed outlet or not. The 1,420 acres make up approximately 2% of the watershed area. The best management practices that are implemented on these fields stop approximately 2% of the sediment from leaving the field each year or 1,120 tons. The same best management practices are stopping 230 lbs of phosphorus from being lost each year or roughly 1.3% of the estimated phosphorus being lost if there were no BMPs implemented on the landscape.

Given that this watershed has similar geology to the East Twin River regarding karst and sink holes, the same analysis was completed to determine which fields were potentially contributing to the watershed outlet. 857 of the 1,420 field acres are estimated to be contributing to the outlet. The estimated reduced sediment and phosphorus from getting to the watershed outlet from these 857 acres is 1.2% and 0.8% respectively of the estimated loads exiting the watershed.

The project fields in the Anhapee River subwatershed are helping reduce sediment and phosphorus lost to the outlet by 1.2% and 0.8% respectively.

7.2.3 SCENARIO DEVELOPMENT

7.2.3.1 East Twin River Cover Crop

PTMApp has the ability to estimate best management practice implementation benefits at scale, allowing the Peninsula Pride group to look at different scenarios of what kind of water quality improvements they could expect if implementation of a specific practice at scale were to be completed.

One scenario was developed for the East Twin River to look at what sediment and nutrient reduction opportunities were possible if 25% of the agricultural landscape adopted cover crops. This scenario started with the baseline assumption that there are currently no conservation practices on the landscape and the reduction benefits would show the maximum reduction opportunities. The scenario estimates that by applying cover crop to 25% of the agricultural lands within the East Twin Rivers watershed (4,775 acres), there would be a 16% reduction in sediment leaving the watershed and a 13% reduction in the amount of phosphorus leaving the watershed.

Although this is just a scenario, this type of analysis allows the Peninsula Pride group to have an additional tool to used when identifying next steps for cost share of BMP, working through specific water quality problems or regulations (i.e. TMDL), and helps quantify the impact that conservation is having on the landscape to a broad audience.

Implementing cover crops on 25% of the agricultural landscape within the East Twin River subwatershed is estimated to reduce sediment and phosphorus losses at the watershed outlet by 16% and 13% respectively.

7.2.3.2 Watershed-Wide Nitrogen Mitigation Quantification

The PPF Board sought information regarding how to quantify what Peninsula Pride is currently doing in regard to mitigating nitrogen infiltration risk and for where to improve upon nitrogen infiltration risk management. As part of this project, areas within the project boundary were identified, based on publicly available information, as to their nitrogen infiltration risk. This map was presented in the Year 1 Report. A more refined map of the project area narrowed down nitrogen risk locations to estimated high areas of nitrogen loss. This map was presented to the Board of Directors as a tool to use when discussing how to best allocate cost-share dollars.

8 PROJECT SPONSORS

This project was made possible by:

- Agropur
- Cargill
- Compeer Financial Fund for Rural America
- Dairy Farmers of Wisconsin
- Farmers for Sustainable Food
- GreenStone Farm Credit Services
- Houston Engineering, Inc.
- Innovation Center for U.S. Dairy
- National Fish and Wildlife Foundation Sustain Our Great Lakes Grant Program
- Natural Resources Conservation Service
- Nicolet National Bank
- Peninsula Pride Farms
- Professional Dairy Producers Foundation

9 CITATIONS

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