

STAR PAY-FOR-PERFORMANCE PROGRAM

for Commodity Merchandisers and
Consumer Packaged Goods Companies



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Saving Tomorrow's Agriculture Resources



STAR WAS DEVELOPED BY FARMERS, FOR FARMERS

Farmers deserve recognition for their commitment to land stewardship and soil health. STAR allows farmers to evaluate their current production system, identify areas for improved management, document their progress and share their successes.

Steve Stierwalt and Joe Rothermel, farmers in Champaign County, IL, developed the STAR tool in 2017

WHY STAR?

-  EASY, FIELD-LEVEL SELF-ASSESSMENT
-  INFORMED BY LOCAL RESEARCH
-  ROADMAP TO DECREASE NUTRIENT AND SOIL LOSS
-  RECOGNITION FOR CONSERVATION PRACTICES
-  CONNECTION TO LOCAL TECHNICAL ASSISTANCE

HOW IT WORKS

The STAR evaluation system assigns points for management activities on an annual basis. Participants answer a series of simple questions about their crop rotation, tillage, nutrient applications, and use of conservation practices to generate their overall field score. STAR relies on the expertise of a local science committee, made up of university researchers, conservation professionals, and farmers, to assign the highest point values to practices identified to address local resource concerns. **Scores are converted to a STAR rating of 1 to 5 STARS, with 5 STARS indicating commitment to a suite of practices proven to improve soil health and water quality.**



Across the board, conservation practices have made our farm more profitable. Our system, as a whole, is more efficient than it ever has been before.

**FRANK RADEMACHER
GIFFORD, ILLINOIS**

MOST COMMON 5-STAR PRACTICES

Below are the most common practices implemented on Illinois 5-STAR fields in Crop Year 2019.



used no-till or strip till management



planted a winter hardy cover crop



applied P & K based on soil tests or removal rates



used variable rate technology

ENVIRONMENT



- Cleaner water
- Healthier soils

CONSERVATION PROFESSIONALS



- Benchmarks for assessing progress toward local environmental & conservation goals
- Entry point to engage farmers in soil health conversations

As of 2020, IA, MO, and CO have all adopted the STAR Initiative.

**STAR
BENEFITS
ALL**

NON-OPERATING LANDOWNERS



- Pathway to increased farm resiliency and improved soil health
- Connection to local farmers committed to conservation

INDUSTRY PARTNERS



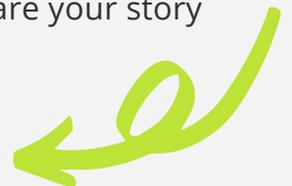
- Simple tool to document continuous improvement and provide client recognition
- Creation of common language across the supply chain

FARMERS & RANCHERS



- Quick & confidential self-assessment
- Opportunity to share your story

Interested in getting STARted today? Contact us below!



STAR'S PAY-FOR-PERFORMANCE (PfP) PROGRAM

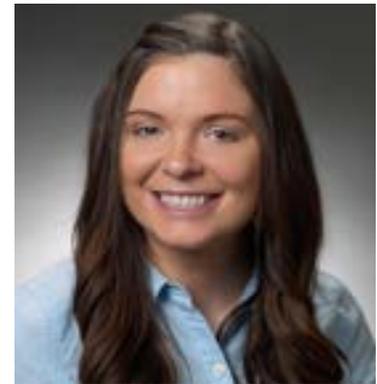
The STAR Pay-for-Performance (PfP) Program allows various sectors of the food, fiber and fuel value chains to incentivize conservation through the use of STAR. Within a company's desired geography, incentives are offered to producers that improve their fields' STAR Rating across growing seasons or maintain a maximum 5-STAR Rating. The aggregated environmental and programmatic outcomes of PfP participants are reported to the companies involved (Program Partners) and can be utilized in communications to consumers.

Benefits of a STAR Pay-for-Performance Program

A STAR PfP Program provides direct and indirect value to various sectors of the value chain, including:

STAR Producer Participants

- Creates the market pull and economic incentives needed to motivate middle- to late-adopters to implement conservation practices.
- Uses the intuitive, easy-to-understand STAR Initiative for producers to assess their current management practices.
- Provides a roadmap for producers to increase their conservation impact.
- Connects producers to free, professional conservation technical assistance.
- Ensures individual producer data privacy, as only aggregated outcomes are shared with Program Partners.
- Incentivizes and motivates producers to adopt and/or maintain conservation practices by increasing incentives for improvements. For example, the incentive structure for 2022 is shown in Figure 1:



"At Kellogg, we've found that giving producers the flexibility and freedom to make data-driven farm decisions motivates them to find cost-effective solutions to conservation challenges. The Pay-for-Performance Program is a powerful conservation approach that enables us to partner with producers in our ingredient supply chains on solutions that de-risk conservation practice adoption."

- Mary Gallagher

North America Responsible Sourcing
Kellogg Company

Figure 1. STAR Rating Scale and Incentive Structure for 2022



Payments for 2, 3, and 4-STAR Ratings are received the year improvement is documented, while payment for 5-STAR Ratings can be received year after year. Receive a \$5/acre 'jump' bonus if improvement over two years is more than 1 STAR Rating (i.e. 1-STAR to 3-STAR, 2-STAR to 4-STAR, etc). Note: the STAR Steering Committee sets the incentive rates annually.

Program Partners:

- Helps meet corporate sustainability goals. For example, a STAR PfP Program could contribute towards some of the United Nation's Sustainable Development Goals, including "#13 – Climate Action" or "#15 – Life on Land."
- Provides a cost-effective method for linking with an established, scientifically rigorous and verified conservation program that is applicable across multiple geographies and agricultural production systems.
- Offers an opportunity to connect with producers directly (if permission is granted) and to create consumer-facing stories about producers' conservation activities.
- Creates a mechanism for third-party verification of the Scope 3 claims accounting methods, if desired.
- Generates the prospect of a multi-year program during which a baseline and changes in outcomes can be measured and reported.

PfP PROGRAM YEAR AT-A-GLANCE

The following example schedule details what a Program Partner can expect throughout a STAR PfP Program year. While Partners would support a PfP Program for two years at a minimum, an ideal STAR PfP Program length is four years. The two-year PfP Program minimum allows producers to show at least one year of improvement. With a four-year PfP Program, producers could show improvement in both crops across a normal two-crop rotation.

Time Period	PfP Program Activities
February	STAR Steering Committee sets PfP Program Fees & Incentive Rates for the upcoming Crop Year.
March - May	<ul style="list-style-type: none"> • PfP Program Partners: <ul style="list-style-type: none"> - Indicate interest in a PfP Program to STAR. - Meet with STAR staff to discuss geography and particular Partner Program goals that could influence the incentive payout, such as target geographic area, number of producers or number of acres. - Confirm if third-party verification will be conducted. • Merchandiser Partner develops producer-facing outreach materials. • STAR reviews the final PfP Program outreach materials prior to publication. • A Contract for Services and/or MOU between STAR and all involved parties is executed.
June - August	<ul style="list-style-type: none"> • The Merchandiser Partner conducts PfP Program outreach to producers and enrolls producers in the PfP program. • STAR Licensees provide technical assistance upon producer's request. • PfP Program-enrolled producers complete the STAR field form.
September 1	The Merchandiser Partner submits the list of enrolled producers and fields to STAR.
October 1	STAR provides the list of Program participants that qualify for incentive payments to the Merchandiser Partner.
October 15	Merchandiser Partner notifies PfP Participants of their incentive payments, pending completion of STAR verification.
November 15 - January 31	If PfP Program acre/participant goals are not met, the Merchandiser Partner can conduct post-harvest outreach to enroll additional growers in the PfP Program for the remainder of the STAR crop year, which ends January 31.
February - March 15	<ul style="list-style-type: none"> • STAR conducts its standard verification process. If a PfP participating field is randomly selected for the STAR verification process and fails STAR's verification, the PfP participant will not receive an incentive payment for that field. • STAR submits a final list of PfP Program Participants who qualify for incentive payments.
March 16-31	Merchandiser Partner executes incentive payments to qualifying PfP participants.
April 1	STAR PfP Program Outcomes are delivered to the PfP Partners.

PfP PROGRAM DETAILS

Incentive Structure

Incentivizing Change and Continued Conservation

The STAR Initiative is unique in how it recognizes producers who are improving in their conservation journey, as well as producers who are early adopters of conservation. As a result, the PfP incentive structure consists of two types of incentives: the Change Incentive and the Flat Incentive. A Change Incentive notes an improvement in STAR Rating over two years on the same field while a Flat Incentive rewards producers whose fields have the high STAR Rating (5-STARs). If producers show initiative and raise their STAR Rating dramatically over two years, i.e., more than just the next STAR Rating, a Jump Incentive of \$5/ac is added on top of the Change or Flat Incentive.

STAR's incentive payment structure for 2022 is shown in Table 1. This payment structure includes Change Incentives for three levels of improvement and a Flat Incentive for fields with a 5-STAR Rating. The STAR Steering Committee sets the incentive payment rates annually.

Table 1. STAR PfP Incentive Payment Structure for Crop Year 2022

Change Incentive (one time per Rating per field)	Payment per Acre
1 → 2-STAR	\$5
2 → 3-STAR	\$10
3 → 4-STAR	\$15
Flat Incentive (can receive multiple years)	Payment per Acre
5-STAR	\$20

Jump Incentive: \$5/ac 'bonus' if improvement over two years is >1 STAR Rating (i.e. 1-STAR to 3-STAR, 2-STAR to 4-STAR, etc).

Acre-based vs. Bushel-based Incentives

STAR was developed to encourage and accelerate conservation on the ground. With this ethic in mind, the incentive structure is based on the acre, NOT the bushel. This is because the environmental benefits of conservation practices are realized at the "ground" level (acre), not at the combine (bushel).

Terms Regarding Other Incentive Programs

To avoid multiple companies 'counting' outcomes from a single field, fields enrolled in the PfP Program cannot be enrolled in any other private environmental incentive programs (for example, private carbon markets). It is the responsibility of the Partner to notify producers of this when signing/enrolling into the PfP Program (see Appendix A, Grower Agreement Example for an example). However, PfP Program-enrolled acres are eligible if the field is also enrolled in publicly funded programs, such as USDA or state-based conservation programs.

Other Considerations

Other considerations for the PfP Program incentive structure include:

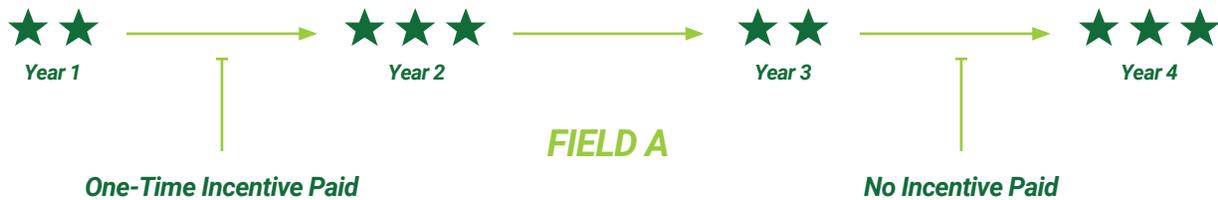
- Program targets:
 - Participant criteria – including the geographic area in which the STAR fields are located or fields on which only qualifying crops during the crop year are grown.
 - Number of producers
 - Number of acres
 - Number of fields
- Participant prioritization – if program constraints exist, such as number of acres or available incentive funds.

These considerations will be discussed among the Partners and agreed upon prior to signing a Contract for Services with STAR.

Ineligibility Due to Back-Sliding

In Year 4 and beyond of a PfP Program, fields will not be eligible for an incentive payment if they were previously rewarded for the same STAR Rating improvement. For example, in Figure 2, Field A received a Change Incentive payment for achieving an improvement from 2 to 3-STARs in Year 2 of the PfP Program. This same field would NOT be eligible to receive a Change Incentive payment if the field went back down to a 2-STAR Rating in Year 3 and went back up to a 3-STAR Rating in Year 4 of the PfP Program. It would only be eligible for another Change Incentive Payment if Field A achieved a 4-STAR Rating or a Flat Incentive payment for a 5-STAR Rating in Year 3.

Figure 2. STAR Incentive and Back-Sliding Illustration



STAR PfP Program Fees

In addition to providing funding for producer incentive payments, PfP Partners are expected to compensate STAR for PfP Program-related costs. The STAR Initiative prides itself on offering local technical assistance to producers through County Soil & Water Conservation District (SWCD) staff. To adequately compensate for local technical assistance, the target geographic range is factored into the total Program Fee. The schedule below illustrates Crop Year 2022 PfP Program fees.

A custom Program Fee can be developed if an interested Consumer Packaged Goods (CPG) doesn't have the support of their Merchandiser (as outlined in the Merchandiser Roles and Responsibilities on the next page). The increased PfP Program Fee would reflect the cost of STAR staff conducting farmer outreach, receiving grower agreements and processing farmer payments.

The PfP Program Fees also incentivize Partners to consider higher acreage targets. The cost/acre incentivized decreases as the target acreage increases.

Table 2. STAR PfP Program Fee Schedule for Crop Year 2022

Acre Target/Year	Geographic Range* (# of Counties)	STAR PfP Program Fee/Year
0 - 25,000	1-4	\$20,000
25,001 - 50,000	1-7	\$25,000
50,001 - 100,000	1-15	\$30,000

**If desired Geography is higher than noted for a particular Acre Target, add \$1,000/additional county*

Partner Roles and Responsibilities

STAR's PfP Program can fit many supply chain partners' needs, including seed production, input providers and CPGs. The following Roles and Responsibilities described use the example of a CPG in collaboration with their Merchandiser.

Table 3. Summary of Partner Roles of a STAR PfP Program

Partner	Role
All	<ul style="list-style-type: none"> • Agree on PfP Program Incentive Structure considerations (geographic area, scope, goals). • Execute a Contract for Services, including appropriate Data Usage Agreements. <ul style="list-style-type: none"> - Key topics covered in the Data Usage Agreement are highlighted in Appendix B.
STAR	<ul style="list-style-type: none"> • Sets PfP Incentive Rates yearly, by March for the upcoming Crop Year. • Implements the STAR Initiative, including scoring fields, providing technical assistance and recognition to STAR participants as requested, and completing STAR's verification protocol. <ul style="list-style-type: none"> - STAR's verification protocol is described in Appendix C. • Serves as liaison with local STAR licensees in the PfP Program's geographic area. • Implements the PfP Program in coordination with Merchandiser/CPG. • Provides yearly PfP Program environmental and programmatic outcomes reports.
Merchandiser	<ul style="list-style-type: none"> • Creates awareness about the PfP Program with its producer customers through promotion and outreach activities. • Enrolls producers by obtaining signed agreements noting eligibility, verification and confirming field is not already enrolled in a private ecosystem market. <ul style="list-style-type: none"> - An example Grower Agreement is provided in Appendix A. • Submits PfP producer enrollment information to STAR. <ul style="list-style-type: none"> - An example of shared enrollment information is in Appendix D. • Communicates with CPGs about the program. • Conducts/oversees additional supply chain accounting/verification, if desired (beyond STAR's standard verification protocol.) <ul style="list-style-type: none"> - This may require an additional data privacy agreement. • Issues incentive payments to qualified producers.
CPG	<ul style="list-style-type: none"> • Provides Funding (Merchandiser could also provide funding.) • Conducts/oversees additional supply chain accounting/verification, if desired (beyond STAR's standard verification protocol.) <ul style="list-style-type: none"> - This may require an additional data privacy agreement. • Develops and implements communications for consumer/public-facing stories (in alignment with communication guidelines for programmatic and environmental outcomes.)

STAR PfP Program Outcomes

The STAR PfP Program, in contrast to other supply chain sustainability initiatives, rewards producers for their performance, not simply participation. Since incentives are received only if a participant improves their Rating or maintains the highest Rating, STAR can provide Partners a robust list of aggregated environmental and programmatic outcomes. These outcomes can be utilized internally and in communications with consumers and shareholders. Outcomes for any given Crop Year will be available the following April (i.e., outcomes from the 2022 Crop Year would be available by April 2023).

The following outcomes are reported, and the methodology for calculating the practice-specific environmental outcomes can be found in the appendix:

Programmatic Outcomes (Total and by each Crop):

- # of Producers Participating
- # of Fields
- # of Acres
- % Fields with “Improved Rating” and % Fields with 5-STAR Rating (Flat Incentive)
- % Fields using various conservation practices (soil sampling, variable rate technology and more)

Environmental Outcomes (Tables provided for All Fields and by each Crop):

Note: Environmental outcomes are aggregated to the program level. STAR does not provide field-level environmental outcomes as we use a general approach based on county-level emission reduction coefficients and loading estimates.

Practice	% of Fields Using this Practice	NPS NO3-N Loss Avoided (Lbs.)	NPS TP Loss Avoided (Lbs.)	Sediment Delivery Avoided (Tons)	Carbon Sequestration and GHG Emission Reduction (CO2e) (Tonnes)
Winter-hardy cover crops	X	X	X	X	X*
Applying nitrogen at or below MRTN [^] rates	X	X			
Applying phosphorus at or below removal rates	X		X		
Use of no-till/strip-till	X		X	X	X

* Non-legume winter-hardy cover crops only [^]Maximum Return to Nitrogen

Communicating Outcomes

STAR is committed to building trust and transparency throughout the supply chain. Data sharing agreements and methodologies for calculating environmental performance estimates are publicly available. All reported metrics are calculated using currently accepted research values on a per-practice basis and are intended to provide an estimate of practice-level performance. Given the limited availability of nutrient, sediment and GHG reductions from stacked practices (i.e., multiple practices on the same field), current environmental accounting is conducted on a per-practice basis and is not an additive. The following examples show how a Partner could communicate outcomes of the PfP Program:

- “The use of cover crops by STAR farmers in XX company’s PfP Program accounted for XX lbs of nitrate-nitrogen kept in the field, XX lbs of phosphorus kept in the field, XX tons of sediment kept out of waterways, as well as prevented the equivalent of XX metric tons of CO2e emissions.”
- “By applying N at or below MRTN rates, STAR farmers avoided ___ lbs of nitrate loss.”

- “By applying P at or below removal rates, STAR farmers avoided ____ lbs of phosphorus loss.”
- “The use of no-till and strip-till by STAR farmers in XX company’s PfP Program accounted for XX lbs of phosphorus kept in the field, XX tons of sediment kept out of waterways, as well as prevented the equivalent of XX metric tons of CO2e emissions.”

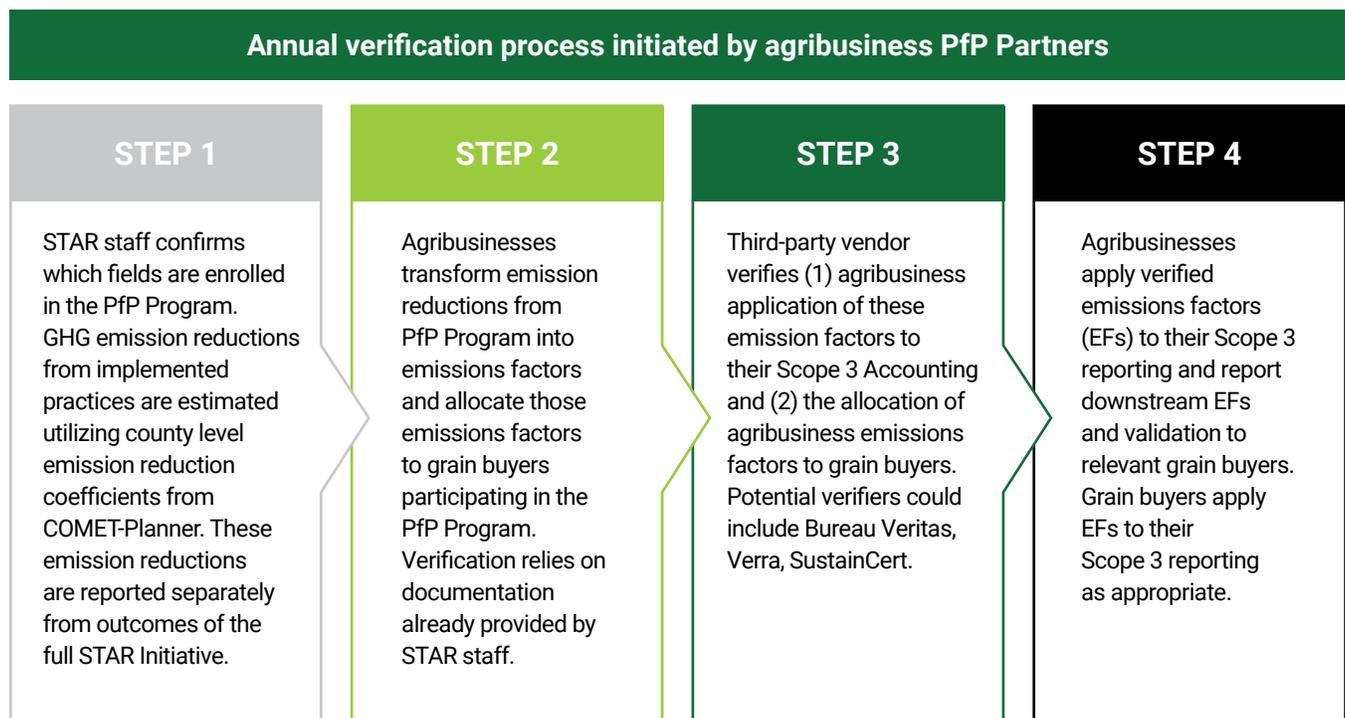
Environmental outcomes can be converted to metrics to provide context. For example, CO2e estimates can be converted to number of passenger vehicles driven for one year or other equivalency metrics using the Environmental Protection Agency’s Greenhouse Gas Equivalencies Calculator available here: <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>.

The STAR team will work with Partners to ensure the outcomes and metrics are being represented correctly, and will provide final review of public facing communications.

Supply Chain Accounting

If STAR conducts verification of its program design, we will note it here.

If the Merchandiser and/or CPG desire additional third-party verification to meet their corporate goals or apply their PfP program outcomes to their Scope 3 Accounting, it will be the responsibility of the Partner to implement and cover the costs associated with the additional verification, and to note that possibility on any grower agreement. The following illustration demonstrates an example of steps needed to utilize STAR PfP Program outcomes in Scope 3 reporting (assuming STAR has completed a program design verification):



APPENDICES

Appendix A: Example PfP Program Grower Agreement

This STAR Pay-for-Performance Program Agreement ("Agreement") is made as of the _____ day of _____, 20____ between Merchandiser ("MERCHANTISER") and _____ ("GROWER").

- 1) MERCHANTISER agrees to provide the following in exchange for the full participation by the GROWER in the MERCHANTISER'S STAR Pay-for-Performance Program ("Program"):
 - a) A cash incentive based on STAR rating increase or achievement of 5 stars, according to the payment structure listed in the program will be paid to the GROWER for acres enrolled in the Program after the STAR Field Form is complete and the information submitted to the STAR coordinator. Incentive payment is limited to ____ acres per GROWER per year.
 - b) Cash incentive will be paid regardless of other public support funds. Acres compensated in this program cannot receive payment from other privately funded sources.
 - c) MERCHANTISER will provide payment after verification of STAR rating by STAR Verification Committee and after program verification procedure has been completed, approximately April 1, 20____.
 - d) Assurance that MERCHANTISER customer partners will only have access to field information in aggregate form and that no individual field data will be shared.
 - e) MERCHANTISER will notify GROWER of payment eligibility by October 15.
- 2) The GROWER will agree to provide the following in exchange for the concessions mentioned above:
 - a) Sign up for the Program and submit STAR Field Forms for at least one field between July 1 and August 31.
 - b) Commit to submitting the necessary information in an accurate and timely manner.
 - c) Participate in the STAR Verification procedure if included in the randomly selected group.
 - d) Ensure that the participating acres are not enrolled into or committed to any other private incentive sustainability or regenerative agriculture programs (e.g., carbon credit program).
 - e) Provide field names and acres being considered for the program in the table below. This will allow STAR to 'match' the enrolled fields in their database.

Field Name	Number of Acres

- 3) This Agreement may be amended or modified in whole or in part only by written agreement executed by all parties hereto and making specific reference to this Agreement.
- 4) This Agreement shall be governed by the law of the State of _____

IN WITNESS WHEREOF, the undersigned have executed the Agreement as of the date first written above.

MERCHANTISER

GROWER

By: _____

By: _____

Name: _____

Name: _____

Title: _____

Appendix B: STAR Team Member Data Usage Agreement

The key points discussed in the “Nondisclosure Obligation” section of the Team Member Agreement are:

1. The team member may only use STAR data in support of the STAR Initiative and exclusively for such work as requested or contracted.
2. STAR data may only be shared with others that are legally bound by a STAR Team Member Data Usage Agreement.
3. STAR data may not be shared with a third party unless specifically agreed to by the STAR farmer participant and an authorized STAR representative.
4. Farmer data may be collected by, reported to, published by, and used by Champaign County Soil and Water Conservation District (CCSWCD) and STAR to support STAR activities. Aggregated, anonymized information from these data may be provided to third parties, and the use of such information is limited to those activities that promote the adoption and use of conservation efforts. All third parties to whom CCSWCD or STAR make such information available may be required to sign an agreement that contains restrictions consistent with the Team Member Agreement.
5. Farmer data provided by STAR farmer participants or their representatives must not be transmitted to or be accessible by anyone who has not signed a STAR Team Member Data Usage Agreement without permission of the farmer or his/her representative.

Appendix C: STAR Verification

Overview of Illinois STAR Verification Procedures

To establish STAR as a credible evaluation tool, STAR is committed to verifying the practices reported on a subset of randomly chosen Field Forms each crop year. As stated on the Field Form, STAR participants acknowledge that their fields may be randomly selected for Verification. Verification is handled by STAR's Verification subcommittee and volunteer SWCD licensees. The information gathered will be private and confidential with only aggregated data shared outside of the volunteers and committee members. Verification involves collecting evidence from STAR participants to document the reported practices on a particular Field Form.

Timing

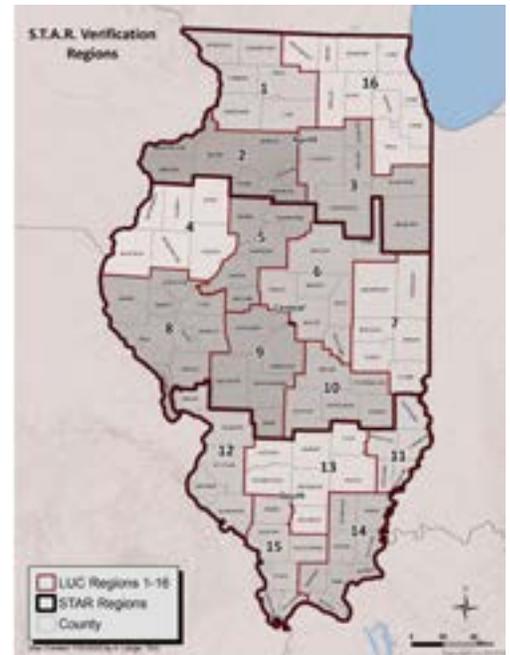
Verification takes place immediately following the end of every STAR crop year (i.e. Crop Year 2021's Verification occurs in February and March 2022). A grower selected for Verification can expect the process to take roughly one hour, including being notified, collecting documentation, and speaking with the Verifier.

Field Selection

All Field Forms are grouped into distinct geographic regions in Illinois. The square root of the total number of STAR fields from each region determines the number of fields to be randomly selected for Verification.

Verification Process (for a participant whose field is selected)

1. In early February, a STAR participant will be notified (by their region's STAR Verifier) that their field has been selected for Verification. Verifiers are often SWCD employees that have experience administering STAR in their own counties.
2. The Verifier will work with the STAR participant to complete a STAR Verification Report for each selected Field.
3. To complete the Report, Verifiers contact each assigned STAR participant and gather evidence for the practices reported on the Field Form. A variety of evidence can be used to document a practice depending on the type of farming operation and records available. See the table below for a list of acceptable forms evidence for each section of the Field Form. The type of evidence provided is at the discretion of the STAR participant.
4. Verifiers complete the Report and collect the evidence for the Verification Committee to review.
5. STAR's Verification subcommittee reviews the Reports and validates the process with its own internal review. Any disputed Verifications will be reevaluated. Any participant who is unable to provide adequate evidence for Verification will be included in Verification in the next crop year.
6. Participants wishing to appeal the Verification process or findings may submit their appeal to the STAR Steering Committee for referral.
7. The Verification Report and collected evidence documenting reported practices serves as the record of Verification. The records will be kept until June 30th of the year following the Verification.



STAR Verification Report Evidence Item: Only one (1) item needs to be selected for each section.

"Other" evidence can also be submitted for each section if needed.

Evidence - Conservation and Management Practices

- Cost-share program documentation
- Enrollment verification in PCM, EQIP, CSP, etc.
- Conservation Plan on file in the Service Center
- Plans and results from trial(s)
- Dated photo, aerial image, google map coordinates, gis, etc

Evidence - Crop Rotation

- FSA 578 or Crop Insurance APH summary
- Planter or harvest log

Evidence - Cover Crops (Summer 2021 - Spring 2022)

- Dated pictures of growing cover crops
- Dated drone imagery confirmation
- Receipts and seed tags
- FSA 578 crop acreage report or NRCS Cost Share

Evidence - Soil Sampling

- Dated copies of soil test results and maps

Evidence - Fall Tillage (starting after harvest of 2021 crop)

- Residue check
- HEL compliance check
- Dated drone imagery confirmation
- Local person to confirm (neighbor, retailer, SWCD or NRCS staff)

Evidence - Spring Tillage (2022 field operations)

- Residue check
- HEL compliance check
- Dated drone imagery confirmation
- Local person to confirm (neighbor, retailer, SWCD or NRCS staff)

Evidence - Nutrient Management (Fall 2021 - February 2022)

- Dated spread maps as applied or application logs
- Invoice of products and amounts billed
- Manure application rate and sample test results
- Copy of MRTN plan

Evidence - Nutrient Management (March 1 - Summer 2022)

- Dated spread maps as applied or application logs
- Invoice of products and amounts billed
- Manure application rate and sample test results
- Copy of MRTN plan

Evidence - Additional Nutrient Activities

- Dated spread maps as applied
- Copy of MRTN plan

Appendix D: Example Shared PfP Program Data

The following is an example template for sharing PfP Program data with STAR and the Merchandiser Partner.

(Names, Fields added as examples)

ID	Grower Name	Field ID: Name	Field: Acres	2021 STAR Field?	2022 STAR Field?	PfP Qualifying Acres	Payment/Acre	Total Payment
1	John Doe	Home Place	20			20		
		Triangle	80			80		
		Teds	60			60		
2	Sarah Smith	Bobs	25			25		
		Red Barn	160			160		
3	Frank Fisher	Home	55			55		
		Creekside	75			75		
						0		
						0		
						0		
		TOTAL	475			475		

 Partner submits this info September 1

 Partner returns this info October 1

Appendix E: Methodology for Calculating Environmental Outcomes of the STAR Initiative in Illinois

Developed and Written by Emily Bruner, Ph.D., Midwest Science Director, American Farmland Trust

Background

A rough approximation of nutrient, greenhouse gas (GHG) and sediment load reductions from acres enrolled in the Saving Tomorrow's Agriculture Resources (STAR) Initiative are estimated utilizing the data sources, tools and equations listed below. All reported metrics are calculated on a per-practice basis and are meant to provide an estimate of practice-level performance; therefore, such equations are not additive.

Data Sources:

- Acres enrolled in STAR in Illinois
 - Champaign County Soil and Water Conservation District (CCSWCD)
- GHG reductions in Carbon Dioxide Equivalents (CO₂e) from adding a non-legume cover crop to non-irrigated cropland (CPS 340) and switching from intensive till to no-till or strip-till on non-irrigated cropland (CPS 329) as estimated via USDA and Colorado State University's COMET-Planner Tool
<http://comet-planner.com/>
- Nutrient Removal Efficiencies of selected practices - IL Nutrient Loss Reduction Strategy (NLRS)
<https://www2.illinois.gov/epa/Documents/iepa/water-quality/watershed-management/nlrs/nlrs-final-revised-083115.pdf>
- HUC 8 NPS Nutrient Loading – IL NLRS 2019 Science Assessment Update
https://www2.illinois.gov/epa/topics/water-quality/watershed-management/excess-nutrients/Documents/NLRS_SCIENCE_ASSESSMENT_UPDATE_2019%20v7_FINAL%20VERSION_web.pdf
- HUC 8 and Illinois County Boundaries - Geospatial Data Gateway
<https://datagateway.nrcs.usda.gov/>
- Non-irrigated cropland acres per county (calculated as total cropland acres remaining after subtracting irrigated cropland acres reported per county) - 2017 Census of Agriculture
https://www.nass.usda.gov/Quick_Stats/CDQT/chapter/2/table/1/state/IL/year/2017
- Average annual sediment load per county - 2018 IL Department of Agriculture Tillage Transect
<https://www2.illinois.gov/sites/agr/Resources/LandWater/Pages/Illinois-Soil-Conservation-Transect-Survey-Reports.aspx>

Methodology

Nutrients

Non-point Source (NPS) Nitrate-N (NO₃-N) and Total Phosphorus (TP) Load Reductions

County-level Agricultural NPS NO₃-N and TP Loads are estimated using total non-irrigated cropland acres calculated from acres reported by the 2017 Census of Agriculture and the HUC 8 NPS Loads estimated by the 2019 IL Nutrient Loss Reduction Strategy Science Assessment Update averaged for water years 2012 - 2017. Briefly, a weighted average of county area contained within each HUC 8 was used to allocate estimated NPS HUC 8 loads (NO₃N and TP) to the county scale using the following equations:

- Equation 1:** Non-irrigated Cropland Acres in each HUC8 per County = Percentage of Area in each HUC 8 draining the county * 2017 non-irrigated cropland acres for that county
- Equation 2:** Annual Load from non-irrigated Cropland Acres in each HUC8 per County (lbs/yr) = non-irrigated Cropland Acres in each HUC8 per county * Estimated NPS NO₃-N and TP yield (lbs/ac-yr) associated with each HUC8^(a)
- Equation 3:** Annual County NPS Load (lbs/yr) = Sum of Annual Load from non-irrigated Cropland Acres in each HUC8 per County (lbs.) by county
- Equation 4:** Average County NPS Loading (lbs/ac-yr) = Annual County NPS Load (lbs/yr) / Non-irrigated Cropland Acres in each county
- Equation 5:** Annual County NPS Load Reduction (lbs/yr) from Cover Crops = (Average County NPS Loading (lbs/ac-yr)^(b) Acres of Cover Crops enrolled in STAR. per County) * NLRS Nutrient Removal Efficiency of Cover Crops
- Equation 6:** Annual County NPS Load Reduction (lbs/yr) from No-till/Strip-till = (Average County NPS Loading (lbs/ac-yr) * Acres Under No-till S trip-till Management enrolled in STAR per County) * NLRS Nutrient Removal Efficiency of changing conventional tillage to conservation tillage or no-till
- Equation 7:** Annual County NPS P Load Reduction (lbs/yr) from acres applying P at or below Removal Rates = (Average County NPS P Loading (lbs/ac-yr) * Acres Applying P at or Below P Removal Rates enrolled in STAR. per County) * NLRS Nutrient Removal Efficiency of P application rate reduction
- Equation 8:** Annual County NPS Load Reduction (lbs/yr) from acres applying N at or below Maximum Return to nitrogen Rates (MRTN) = (Average County NPS Loading: (lbs/ac-yr) * Acres applying at or below MRTN enrolled in STAR per County) * NLRS Nutrient Removal Efficiency of reducing N application rate

Assumptions:

a) Negative values for NPS NO₃N were not reported in the NLRS and were assumed to be based on mismatches between HUC areas and monitored drainage areas and/or load estimation errors. For the 2019 Update, negative values were reported to facilitate future identification and correction of inappropriate assumptions or errors in calculating point and non-point yields. For the STAR methodology, where negative NPS NO₃N and TP values were reported in the 2019 Science Update for the 2012 - 2017 period, zeros were substituted. This could lead to a slight overestimate of NPS load from agriculture, but given the magnitude of NPS nutrient loading, any potential overestimate would be considered negligible. HUC8s reporting negative values for NPS NO₃N and TP include Lower Illinois - Senachwine Lake, Upper Fox, Upper Rock and Chicago. HUC8s reporting negative values for NPS TP only include Lower Illinois - Lake Chautauqua and Lower Illinois.

b) An estimate of 30% was used for both NPS NO₃N and TP removal efficiencies.

Sediment

Non-point Source (NPS) Sediment Load Reductions

- 9. Equation 10:** Annual Sediment Load Reductions from Cover Crops (tons /yr) = (Average sediment load per acre (tons/ac-yr, averaged across corn and soy estimates provided by the 2018 IDOA tillage transect * Acres of Cover Crops enrolled in STAR per County) * Sediment Removal Efficiency of Cover Crops provided by literature ^(c))
- 10. Equation 11:** Annual Sediment Load Reductions from No-till/Strip-till (tons/yr) = (Average sediment load per acre (ton/ac-yr, averaged across corn and soy estimates provided by the 2018 IDOA tillage transect) * Acres under No-till / Strip-till Management enrolled in STAR per County) * NLRS Nutrient Removal Efficiency of changing conventional tillage to conservation tillage or no-till^(d))

Assumptions:

While average sediment loads per acre vary depending on if the field is planted to corn or soy, in any given year it is assumed that roughly half a county's commodity acres will be in corn or soy, so averaging these estimated erosion rates was considered reasonable for the purpose of calculations.

Truckloads of sediment reported in annual report used an average number of 14 tons per dump truck.

c) Previous studies have reported sediment removal rates by cover crops ranging from 11 to over 90% for Midwest soils. A bibliography compiled by the Sustainable Agriculture Research and Education Program (SARE) and the University of Missouri reported a range of soil loss reduction of 31% to 100% by non-legume cover crops, including rye species. Given these ranges, a Sediment Removal Efficiency estimate of 40% was used in EQ 9.

d) 50% reduction for P assumed to be primarily due to phosphorus attached to soil particles, thus reduction efficiency for P extended to sediment in EQ 10.

Carbon Sequestration and Greenhouse Gas Emissions

Tonnes of Carbon Dioxide Equivalents (CO₂e) Reduced per Year

Calculated using USDA and Colorado State University's online COMET-Planner Tool by selecting IL and the county of interest in Step 1, Cropland Management in Step 2, Cover Crop (CPS 340) and Add Non-Legume Seasonal Cover Crop to Non-Irrigated Cropland or Residue and Tillage Management OR No-Till (CPS 329) and Intensive Till to No Till or Strip Till on Non-Irrigated Cropland in Step 3, and the number of acres utilizing cover crops or no-till / strip-till management enrolled in STAR per county in Step 4. The COMET-Planner Tool provides approximate carbon sequestration and GHG emission reductions in tonnes of CO₂ equivalents (CO₂e) per year. CO₂e estimates were converted to number of passenger vehicles driven for one year using the equations provided by the Environmental Protection Agency's Greenhouse Gas Equivalencies Calculator available here:

<https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>



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