Inset Design Document for Cover Cropping

Intervention Owner: Soil Health Partnership
Intervention Representative: Bayer
Program Representative: Viresco Solutions
Date: October 29, 2020

Contents

1. Introduction

This Inset Design Document follows the standards, definitions, and recommendations laid out in the Carbon Accounting and Insetting Framework. Each section describes the approach this project will take, in relation to the Framework.

Soil Health Partnership (SHP) in conjunction with Bayer, SEC, Climate Smart Group, Applied GeoSolutions, DNDC-ART and Crop Growers developed the "Charting a New Course Carbon Insetting Program" with financial support from Bayer and a United States Department of Agriculture Conservation Innovation Grant (CIG). The goal of this insetting program is to integrate recent advancements in precision agriculture data platforms, high resolution satellite imagery and the OpTIS system to achieve real emission reductions and removals. These emission reductions and removals will be reported in a narrative claim by Bayer. The project includes SHP grower-cooperator sites from eight states in the US Midwest.

2. Program Overview and Site Description

Program Title	Charting a New Course – Carbon Insetting Program
Practice	Cover Cropping
Program Purpose and Objective(s)	The purpose of this program is to reduce direct and indirect greenhouse gas (GHG) emissions from agriculture through cover cropping.
Intended Inset Use	Narrative claim by Bayer
Program Start Date	The implementation date of cover cropping practices varies by farm. The earliest start year in the program of activities will be 2014, with a baseline of 2013.
Expected Lifetime of the Program	The lifetime of the Charting a New Course – Carbon Insetting Program is 17 years (2014-2030).
Intent to Track Insets	If an inset registry becomes available, this program will register and serialize the generated inset credits.
Estimated Emission Reductions/Removals	An estimated 1000 tCO_2e/year are expected to be generated from the joint tillage and cover cropping program for a total of 17,000 tCO_2e over 17 years.
Selected Quantification Methods	An Activity-based Impact Factor approach was developed to estimate the spatial impact of adopting various Climate Smart Agriculture (CSA) practices and provide a robust method for quantifying GHG emissions at subfield to regional scales. The approach couples the Denitrification-Decomposition (DNDC) 9.5 biogeochemistry model with public soil and weather input data to create an analysis framework capable of estimating subfield GHG emissions based on both field location and specific land management practices. Impact factors or GHG reduction coefficients were generated from subfield model analyses completed using publicly available datasets to determine field boundaries, crop productivity values, soil properties and daily weather inputs. In total, approximately 200 million runs were completed at the

<table>
<tr><td></td><td>subfield level and then rolled up to field and county level coefficients using area-weighted averages of subfield results by soil type.</td></tr>
<tr><td>Quantification Method Justification</td><td>The Denitrification-Decomposition (DNDC) model was developed at the University of New Hampshire and simulates biogeochemical cycling in agro-ecosystems. DNDC is a process-based model that examines carbon and nitrogen dynamics to predict carbon dioxide, nitrous oxide, and methane emissions for agricultural ecosystems. The four main sub-models are soil/climate, crop vegetation, decomposition and denitrification. The model can be used for projects in any location around the world with proper soil data for parameterization. Default soil parameters are based on averages for US soils, so further parameterization on a local or regional basis is necessary to ensure accuracy of the simulations. Uncertainty is being assessed by DNDC-ART.

Process models, such as DNDC, are an effective way of quantifying GHG impacts of agricultural management for a large-scale program, company or market (Olander, et al. 2011). The model has been adopted in research projects around the world, is well known and very heavily cited in the United States. An added advantage of DNDC over DayCent, which is a similar process based biogeochemical model, is that DNDC generates uncertainty estimates for outputs.</td></tr>
<tr><td>Program Locations and Site Descriptions</td><td>This program includes 64 sites across eleven mid-west states (Iowa, Illinois, Indiana, Nebraska, Missouri, Ohio, Minnesota, South Dakota, North Dakota and Kansas). Out of these 64 sites, 58 are implementing cover crop practices (two of which are joint cover crop/tillage trials). A breakdown of the cover crop type (by classification category) is presented in the table below. Please see Table 7 in Section 7 for further details on how reported cover crop types were categorized into the available options in the quantification model.

Table 1: Summary of Cover Cropped Acres by Cover Crop Classification in the Program
<table>
<tr><th>Cover Crop Classification</th><th>Number of Site Years[1]</th><th>Total Area Cover Cropped Across all Years (Ha)</th><th>Percent (Based on Ha)</th></tr>
<tr><td>Rye</td><td>77</td><td>559.62</td><td>73.69</td></tr>
<tr><td>Rye/Clover</td><td>2</td><td>18.08</td><td>2.38</td></tr>
<tr><td>Clover/Radish/Rye (All)</td><td>15</td><td>127.75</td><td>16.82</td></tr>
<tr><td>Rye/Radish</td><td>8</td><td>53.98</td><td>7.11</td></tr>
</table></td></tr>
</table>

[1] Site years refers to one year at a given site.

<table>
<tr><td></td><td><table><tr><td>Total</td><td>119</td><td>759.43</td><td>100.00</td></tr></table>
Individual land locations cannot be shared due to data privacy agreements but will be made available to the verifier.</td></tr>
<tr><td>Reporting and Verification Details</td><td>The framework and project documentation are designed to meet ISO 14064-3 standards. The mock verification will be implemented to a reasonable level of assurance (industry standard) and a materiality threshold of 5% will be used. Verification will be based on the annual cropping cycle (1 time/year) and be implemented by a verifier with substantial experience in traditional carbon offset programs. Any participants found to not be in conformance with program requirements will be removed from the quantification. Sampling of sites will be conducted using a stratified random sampling approach.</td></tr>
<tr><td>Program Activity</td><td>Cover cropping is defined for this program as any crop grown in the off-season (regardless of its intended use), geared toward reaching continuous soil cover. The intended purpose of a cover crop can include many different benefits, including increased SOM, fertility, water infiltration, improved soil structure, limited pest and disease outbreaks, erosion prevention, and providing continuous soil cover (UC Division of Agriculture and Natural Resources, 2017).</td></tr>
<tr><td>Other</td><td>Two additional SDG goals were selected – SDG 2 and 6. The approach to estimating and monitoring indicators for these goals is laid out in the Preliminary Review Checklist Spreadsheet under the SDG MP tab and in Table 11 below.</td></tr>
</table>

3. Contact Information

Program Developer Contact Information	Soil Health Partnership Maria Bowman Lead Scientist bowman@ncga.com	Bayer US - Crop Science Jeff Seale Environmental Stakeholder Strategy Manager Jeffrey.seale@bayer.com

4. Additional Program Information

Description of how the Program will Achieve Greenhouse Gas Emission Reductions and Removals

This project will quantify emission reductions and removal resulting from incorporation of a cover crop into the cropping cycle. Use of cover crops and "green manure crops" can provide many benefits to the soil, including increased structural integrity which reduces erosion and increases fertility and water holding capacity. Use of cover crops often also prevents indirect nitrous oxide emissions and improves conditions for carbon sequestration. Cover cropping is a recommended practice in Section 6 of the Carbon Accounting and Insetting Framework.

Cover crop species that produce high volumes of organic material and/or root mass can improve soil health and organic matter, thus increasing carbon sequestration. Diversity in cover crops can promote diversity of soil organisms, which also promotes increased soil organic matter (Natural Resources Conservation Service Conservation Practice Standard Code 340, 2011). Furthermore, for soils that would have been bare under baseline conditions, project scenario cover crops limit soil erosion and lower subsequent nitrogen inputs and losses to the environment when managed for their contribution to soil nitrogen (USDA, 2019).

Additionally, growing a leguminous cover crop can reduce the need for synthetic or organic nitrogen fertilization, due to nitrogen fixation from the planted legumes. Cover cropping can thus decrease both direct and indirect nitrous oxide emissions associated with nitrogen fertilization.

Program Technologies, Products, Services, and Expected Level of Activity

Cover cropping can be implemented in a variety of ways; however, for the purpose of this program is defined as any crop grown in the off-season, regardless of its intended use. In other words, the crop can be a cash or non-cash crop if continuous soil cover is maintained. Cover crops are defined in DNDC as a crop type with alternative grain, stem, leaf, and root biomass fractions and C:N ratios.

The information and data for this project were and will continue to be collected via survey and via direct observation by field managers and interactions with farmers. Other assumptions used to quantify emission changes due to cover crops are described in the Quantification section of this document. The table below summarizes the cover cropping data by year. It is important to note that the coefficients used for each acre in a specific cover crop type will not be the same, since the coefficients also depend on tillage practice, crop rotation, stover harvest, irrigation and nitrogen timing inputs. Additional years will be added to the program of activities as the data becomes available.

Table 2: Summary of Cover Cropped Acres by Year and Cover Crop Classification in Program

Year	Cover Crop Classification	Number of Sites	Total Strip Trial Area Cover Cropped (Acres)[2]	Percent (Based on Acres)
2014	Rye	2	25.01	5.97%
	Rye/Clover	0	0.00	
	Clover/Radish/Rye (All)	1	13.66	
	Rye/Radish	1	6.68	
	Total	**4**	**45.36**	
2015	Rye	16	114.81	20.01%
	Rye/Clover	0	0.00	
	Clover/Radish/Rye (All)	4	32.43	
	Rye/Radish	1	4.73	
	Total	**29**	**151.96**	
2016	Rye	14	108.31	21.10%
	Rye/Clover	1	9.04	
	Clover/Radish/Rye (All)	5	31.52	
	Rye/Radish	2	11.41	
	Total	**22**	**160.28**	
2017	Rye	44	311.49	52.91%
	Rye/Clover	1	9.04	

[2] Please note that the overall sum of acres across all four years will not exactly equal the total found in Table 1 above. This is due to differences in how the data is being summed and associated rounding down for conservativeness.

Year	Cover Crop Classification	Number of Sites	Total Strip Trial Area Cover Cropped (Acres)[2]	Percent (Based on Acres)
	Clover/Radish/Rye (All)	5	50.14	
	Rye/Radish	5	31.16	
	Total	**67**	**401.83**	

Stakeholder Consultation

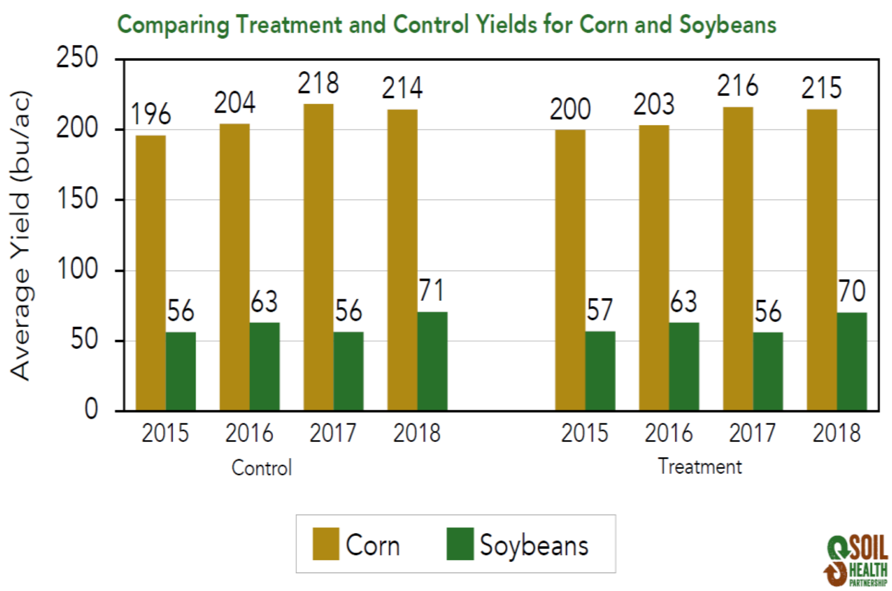
At the beginning of the project, a Carbon Neutral Collaborative Committee was formed. This group consisted of scientists and carbon experts. The purpose of this committee was to advise the project team on the framework's development and piloting. The committee met on November 29, 2016 and on March 21, 2018. The Soil Health Partnership advisory committee has also been engaged along the way and recently completed a comprehensive review of the soil organic carbon methodology, carbon accounting and insetting framework and inset design documents. In addition, the project has been presented to SHP growers in Cochrane, WI (July 11, 2018); York, NE (July 31, 2018), Johnston, IA (August 6, 2018), Indianapolis, IN (August 8, 2018), Columbia, MO (August 13, 2018) and Bloomington, IL (August 15, 2018).

5. Approach Taken to Address Key Insetting Concerns

Table 3 below provides a summary of how this insetting program will address five key issues/concerns associated with GHG accounting.

Table 3: Summary of How Key Issues are Addressed in this Insetting Program

<table>
<tr><th>Issue/Concern</th><th>How Issue is Addressed in this Insetting Program</th></tr>
<tr><td>Eligibility</td><td>Cover cropping practices are surplus to regulation in the US Midwest and not commonly practiced in this region. SHP implemented this practice change with producers on the strip trials through provision of direct technical assistance. Bayer influenced these activities through its membership on SHP’s board, contributions to SHP annual operating budget and investment in the development of the quantification infrastructure and framework for this insetting program.</td></tr>
<tr><td>Leakage</td><td>The post-intervention yield is not consistently difference from the pre-intervention yield as shown in the chart below.



</td></tr>
<tr><td>Double Counting</td><td>The emission reductions/removals from this intervention will be used in a narrative claim. The biggest source of potential double counting with this type of claim is if another company, in addition to Bayer, accounts for the same improved goods and services. To address this risk, Bayer will transparently report this intervention and its involvement in influencing the intervention. SHP will also ensure that carbon credits are not generated from the same activities on the participating farms.</td></tr>
<tr><td>Permanence</td><td>A portion of the emission reductions/removals will be allocated to a buffer pool reserve account. The percentage allocated to this pool will align with the Gold Standard value chain program requirements.</td></tr>
<tr><td>Aggregation</td><td>As recommended in the Carbon Accounting and Insetting framework a flexible program of activities approach is being taken which allows new participants to join once their eligibility has been proven. The baseline for new participants will be the year immediately prior to the intervention (i.e. cover cropping practices).</td></tr>
</table>

6. Identification of risks

Table 4 below summarizes risks associated with this project and associated controls for mitigating these risks. These risks were identified following the guidance found in Section 17 of the Insetting Framework on Risk Assessment.

Table 4: Project Risks and Mitigation Strategies

Risk	Evidence to provide a reasonable level of assurance	Recommended control to mitigate risk
Fields claimed are duplicated or reported to be larger than actual size	Shapefiles to track land areas	Management review of shapefiles vs. area of fields claimed
Data management system does not accurately document cover cropping practices due to technical or user entry errors	Remote sensing data to confirm practices reported were implemented	Management review of data entered for accuracy
Crop type reported is not the crop type grown	Remote sensing data to confirm crop type	Management review of data entered for accuracy and cross comparison with yield data
Insufficient controls over stored data	Process documentation relating to data management and record keeping	Restricted user access to calculations and data
User errors in GHG quantification input data or code	Process documentation and error message tracking	Restricted user access, management review when necessary, and all code will be documented and available
Discrepancies between reported amounts of insets and data management system	Process documentation relating to data management and record keeping for insets	Management review of reported data to ensure it is consistent with underlying DNDC estimates

7. Identification of Baseline and Program Conditions

Baseline Condition

The SHP began in 2014, and now has over 100 growers. Participating growers have designated strip trials on research fields enrolled in the partnership. Some growers on-boarded with the SHP program later than others, so the program/intervention years and associated baseline year vary according to when they joined.

Prior to the program, the farms included in the quantification had "conventional" cropping systems, without incorporation of cover crops[3]. The year that each farm began growing cover crops varies because some growers on-boarded with the SHP program later. The earliest possible year included in this program of activities is 2014. Since data on cropping practices were not uniformly collected in 2013, baseline assumptions are needed for some of the farms where cover cropping began in 2014. Specifically, if the baseline year is 2013, the baseline crop will be assumed to be corn[4], unless data for later years (i.e. 2014, 2015, 2016 & 2017) shows that a corn and soybean rotation is being followed. In this case, the crop

[3] Farms that were cover cropping in the baseline were removed from the analysis

[4] Note: Corn is the most common crop and therefore was assumed to be the baseline crop in the absence of raw data.

immediately prior in the rotation will be used. Otherwise, where data on the baseline crop was gathered for 2013, this data will be used. It is important to note that the baseline crop type is not an input variable itself; however, influences the crop rotation chosen and input for the baseline year (see Table 6 below). In addition to the above assumptions, if wheat was grown in the baseline (regardless of baseline year), the baseline crop was assumed be corn, since wheat cannot be input into the quantification model.
Only the strip trial plots on participating farms will be included in the baseline and intervention conditions and calculations; however, the baseline practices on the strip trial will be consistent with those implemented on the larger farm.

Program/Intervention Condition

Cover cropping interventions are being implemented on SHP farms which are within the same supply shed as where Bayer supplies its products. The geographic boundary for the program is the US Midwest and the corn-soybean production region where 70% of the Nation's N fertilizer is applied.

As stated previously the emission reductions and removals from this project will be used by Bayer in a narrative claim. Bayer's Crop Sciences Division is a global supplier of agricultural inputs and therefore has broad market influence.

The cover cropping practices on the strip trial sites were implemented by producers with support from SHP and influenced by Bayer through its membership on the SHP board, contributions to SHPs annual operating budget and investment in the development of the quantification infrastructure and framework for this insetting program. SHP is a network of growers across the US Corn Belt, who are implementing practices in strip trials on their farms designed to build soil health. SHP provides direct technical assistance on cover cropping to the farms participating in this program and therefore is the agent of change. The strip trials have been and will continue to be used to catalyze broader practice change; however, for the purposes of this program only the emission reductions and removals occurring on the strip trials themselves will be quantified.

Some growers have incorporated different cover cropping management regimes (such as inter-seeding, timing of planting, timing of killing the cover crop, etc.). Furthermore, the type of cover crop varies by farm. Table 7 found in Section 7 provides a summary of the cover crops grown and how they will be categorized into the options available in the quantification model. Shapefiles of the strip trial boundaries were created using Mesa tablets and entered in SMS software and will be used in combination with satellite imagery to confirm a cover crop was grown. A functional unit of emission reductions/removals in carbon dioxide equivalents per hectare will be used to compare baseline and program/intervention emission reductions/removals.

8. Quantification Plan

Quantification of GHG emission reductions/removals was completed using county scale coefficients developed as part of this program with funding from Bayer and a United States Department of Agriculture Conservation Innovation Grant. An in-depth description of how these coefficients were created can be found in *Projected Climate Smart Agriculture Opportunities for Reducing GHG Emissions* (McNunn, et al. 2020).

At a high level, the model estimates subfield GHG reductions/removals associated with adoption of alternative land management practices such as reduced or no-till, cover cropping and alternate nitrogen fertilizer application timing. More specifically, the approach utilizes a modeling framework which couples the DNDC biogeochemistry model (Giltrap et al., 2010; Gilhespy et al., 2014) with public data sources including the 2017 SSURGO soils database (SSURGO 2017) and Daymet weather data service (Thornton et al., 2014) to simulate subfield soil organic carbon (SOC) and nitrous oxide (N_2O) emission changes, which are then converted to a net GHG flux. As stated above, for a comprehensive description please see McNunn et al., 2020. Figure 1 below presents the data flow chart for the Leaf quantification platform.

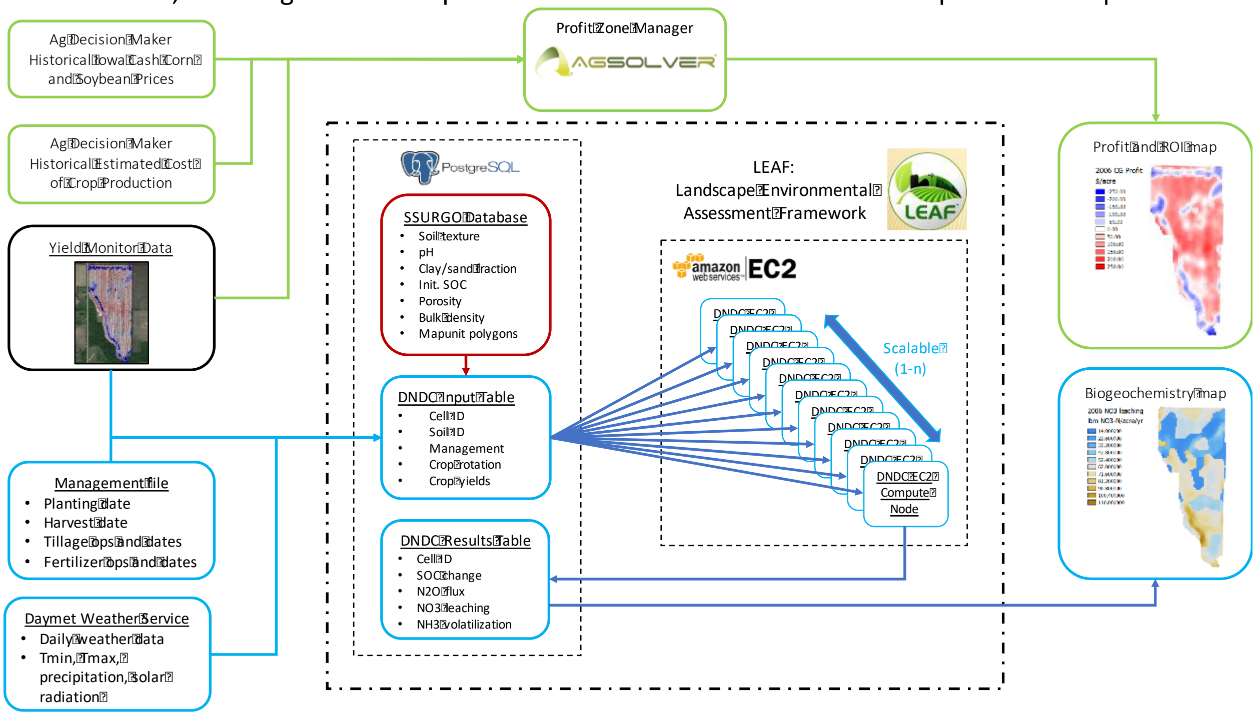


Figure 1: Data Process Flow Chart for the Leaf Platform

To calculate the GHG emission reductions/removals associated with the farms participating in this program the state, county, crop rotation, tillage practice, cover crop, nitrogen timing, stover harvest and irrigation for each strip trial will be entered in the model to determine the appropriate coefficient. However, since the model is limited in input options, some assumptions will have to be made. A summary of these assumptions are provided in Tables 5 through 7 below. Once the coefficients are determined for each farm, the difference between the baseline coefficients and the intervention coefficient will be calculated by intervention year and multiplied by the area of the strip trial to determine emission reductions and removals. It is important to note that changes in fuel use between the baseline and project are not accounted for. The impact of cover crop interventions on fuel use depends on how the cover crop is seeded and terminated. Usually farmers will couple up field operations in order to save money.

Table 5: Input Variable Assumptions/Approach

Input Variable	Assumption/Approach	Justification
Crop Rotation	See Table 5 below. Exclude all farms where sugar beets were part of the rotation, as well as farms where only wheat was grown.	Sugar beets and wheat were not modeled as part of the quantification methodology.
Tillage Practice	Use the reported tillage practice. Vertical till and strip till were both classified as reduced till. If the tillage practice is not reported for the cover crop trials assume the same tillage as in the intervention years. In those cases where there is a reversal, the amount of stored CO_2e released is subtracted from the	This approach is reflective of what happened on the farms. The approach for treating reversals is conservative.

Input Variable	Assumption/Approach	Justification
	ongoing sequestration from the intervention. For example, if a parcel of land is in no till for two years and then reverts to conventional tillage in year three, the flux of emissions from the reversal is quantified and discounted from the overall emission reductions and removals. In other words, the quantification method relies on the modeling tool to estimate the amount of CO_2e that is released upon a reversal of the practice and a loss of soil organic carbon.	
Cover Crop Type	See Table 7 below.	The soil organic carbon methodology only models rye, clover or radish or a combination thereof.
Nitrogen Timing	Assume fall application only on all fields.	Emissions will be higher using this approach.
Stover Harvest	If the field is under no-till or reduced till assume 30% removal. If the field is under conventional tillage assume 0% removal.	If stover harvest occurs, it happens under a reduced till situation and 30% is considered a sustainable level of removal.
Irrigation	Use reported irrigation practices.	This approach is reflective of what happened on the farms.

Table 6: Crop Rotation Classifications for Model Input[5]

Producer Reported Rotations	Classification for Model Input					Notes
	Year 1	Year 2	Year 3	Year 4	Year 5	
Corn, alfalfa, corn, corn/wheat, corn/wheat	CG,SB,CG,SB	CG,SB,CG,SB	CG,CG,CG,CG	CG,CG,CG,CG	CG,CG,CG,CG	
Corn, corn, corn, soybean	CG,CG,CG,CG	CG,CG,CG,CG	CG,CG,CG,CG	CG,SB,CG,SB		
corn, corn, soybean	CG,CG,CG,CG	CG,CG,CG,CG	CG,SB,CG,SB			
Corn, corn, soybean, corn	CG,CG,CG,CG	CG,CG,CG,CG	CG,SB,CG,SB	CG,SB,CG,SB		
Corn, corn, sugar beets, corn						Exclude this farm
Corn, corn, sugar beets, corn, soybean						Exclude this farm
Corn, soybean, corn, corn	CG,CG,CG,CG	CG,SB,CG,SB	CG,CG,CG,CG	CG,CG,CG,CG		
corn, soybean, corn, corn silage	CG,SB,CG,SB	CG,SB,CG,SB	CG,CG,CG,CG	CG,CG,CG,CG		0.3 Removal in last two years due to significant removal
Corn, soybean, corn, corn, soybean	CG,CG,CG,CG	CG,SB,CG,SB	CG,SB,CG,SB	CG,CG,CG,CG	CG,SB,CG,SB	
Corn, soybean, corn, soybean	CG,CG,CG,CG	CG,SB,CG,SB	CG,SB,CG,SB	CG,SB,CG,SB		
corn, soybean, corn, soybean, corn	CG,CG,CG,CG	CG,SB,CG,SB	CG,SB,CG,SB	CG,SB,CG,SB	CG,SB,CG,SB	
Corn, soybean, soybean, No response	Exclude	Exclude	Exclude			
Corn, soybean, winter wheat, corn	CG,CG,CG,CG	CG,SB,CG,SB	Exclude	CG,CG,CG,CG		
Corn, winter wheat, corn	CG,CG,CG,CG	Exclude	CG,CG,CG,CG			
Soybean, corn	CG,SB,CG,SB	CG,SB,CG,SB				
Soybean, corn, corn, soybean	CG,SB,CG,SB	CG,SB,CG,SB	CG,CG,CG,CG	CG,SB,CG,SB		
Soybean, corn, corn, soybean, corn	CG,SB,CG,SB	CG,SB,CG,SB	CG,CG,CG,CG	CG,SB,CG,SB	CG,SB,CG,SB	

[5] Please note that this table only reports each rotation combination once. In other words, if more than one producer employed the same rotation, it is not duplicated. Nevertheless, all producers following the same rotations were classified the same for the model input.

Producer Reported Rotations	Classification for Model Input					Notes
	Year 1	Year 2	Year 3	Year 4	Year 5	
Soybean, corn, soybean	CG,SB,CG,SB	CG,SB,CG,SB	CG,SB,CG,SB			
Soybean, corn, soybean, corn	CG,SB,CG,SB	CG,SB,CG,SB	CG,SB,CG,SB	CG,SB,CG,SB		
Soybean, corn, soybean, soybean	Exclude	Exclude	Exclude	Exclude		
Soybean, corn, soybean, sweet corn	CG,SB,CG,SB	CG,SB,CG,SB	CG,SB,CG,SB	CG,SB,CG,SB		
Soybean, corn, soybean, winter wheat	CG,SB,CG,SB	CG,SB,CG,SB	CG,SB,CG,SB	Exclude		
Soybean, corn, winter wheat, corn	CG,SB,CG,SB	CG,SB,CG,SB	Exclude	CG,CG,CG,CG		
Soybean, soybean, corn	Exclude	Exclude	Exclude			
Soybean, soybean, soybean, corn	Exclude	Exclude	Exclude	Exclude		
Soybean, winter wheat, corn	Exclude	Exclude	CG,CG,CG,CG			
Soybean, winter wheat, soybean, corn	Exclude	Exclude	CG,SB,CG,SB	CG,SB,CG,SB		
Wheat						Exclude this farm
Winter wheat, corn, soybean, corn	Exclude	CG,CG,CG,CG	CG,SB,CG,SB	CG,SB,CG,SB		
Winter wheat, corn, soybean, corn, corn	Exclude	CG,CG,CG,CG	CG,SB,CG,SB	CG,SB,CG,SB	CG,CG,CG,CG	
Winter wheat, corn, soybean, soybean	Exclude	Exclude	Exclude	Exclude		
Winter wheat, soybean, corn, soybean	Exclude	Exclude	CG,CG,CG,CG	CG,SB,CG,SB		

Table 7: Cover Crop Type Classifications for Model Input

Producer Reported Cover Crops	Classification to Match Model Coefficients
Winter Kill/Clover	Clover
Rye/Clover	Rye/Clover
14 Way Mix	Clover/Radish/Rye (All)
5 Way Mix	Clover/Radish/Rye (All)
Mix (Winter Kill and Over Winter)	Clover/Radish/Rye (All)
Oats/Radish/Clover/Rapeseed	Clover/Radish/Rye (All)
Oats/Vetch/Rye	Clover/Radish/Rye (All)
Annual Rye/Radish/Turnip/Clover	Clover/Radish/Rye (All)
Mix (Clover/Radish/Barley/Rape)	Clover/Radish/Rye (All)
Mix (Radish/Rye/Etc.)	Clover/Radish/Rye (All)
Mix (Rye/Turnip/Radish/Clover)	Clover/Radish/Rye (All)
Oats/Barley/Alfalfa Milo/Turnips	Clover/Radish/Rye (All)
Radish/Peas/Oats	Clover/Radish/Rye (All)
Annual Ryegrass	Rye
Annual Ryegrass and Rapeseed	Rye
Barley	Rye
Cereal Rye	Rye
Mix (Rye/Oats)	Rye
Wheat	Exclude
Winter Kill Oats	Rye
Winter Wheat/Kamilina	Exclude
Winter Kill Oats and Radish	Rye/Radish
Barley/Radish	Rye/Radish
Cereal Rye and Radish	Rye/Radish
Mix (Annual Rye/Brassica/Radish/Turnip)	Rye/Radish
Mix (Rye/Buckwheat/Radish/Turnip/Brassica)	Rye/Radish
Mix (Rye/Oats/Radish/Rapeseed/Turnips)	Rye/Radish
Winter Kill Oats/Radish	Rye/Radish
Winter Kill Oats/Radish/Turnips	Rye/Radish

9. Monitoring Plan

A monitoring plan for each variable input into the GHG quantification platform based on farm data are provided in Tables 8 to 10 below. Monitoring Plans for SDG 2 and SDG 6 are shown in Table 11. This monitoring plan was established using guidance from Section 15 on Data Management Systems and Collation of Evidence in the insetting framework. Please note that all the additional variables input into the quantification platform are based on assumptions listed in the quantification section above. The monitoring plan for changes in tillage practices are documented in the complementary Tillage Inset Design Document.

Table 8: Field Size and Farm Location

Data parameter	Field Size and Farm Location
Estimation, modeling, measurement or calculation approaches	Measurement
Data unit	Acres
Sources/Origin	GPS shapefiles from Mesa tablets
Monitoring frequency	Annual
Description and justification of monitoring method	GPS data is the most reliable methods of gathering this information.
Uncertainty	There is a low level of uncertainty associated with the above parameter.

Table 9: Cover Crop Type

Data parameter	Cover Crop Type
Estimation, modeling, measurement or calculation approaches	Observation
Data unit	N/A – categorical data
Sources/Origin	Farm survey and observation by field managers
Monitoring frequency	Annual/Continuous
Description and justification of monitoring method	This is the most practical method of determining the cover crop type.
Uncertainty	There is a low level of uncertainty associated with this parameter since this is confirmed by the field manager.

Table 10: Crop Rotation

Data parameter	Crop Rotation
Estimation, modeling, measurement or calculation approaches	Estimation
Data unit	N/A – categorical data
Sources/Origin	Farm survey
Monitoring frequency	Continuous
Description and justification of monitoring method	This is the most practical method of fitting the crop rotations reported to the available model inputs.
Uncertainty	There is some uncertainty associated with this parameter due to the possibility of inaccurate reporting and misrepresentation. The rotation will also be confirmed by the field manager.

Table 11: SDG's 2 and 6

Corporate SD Contribution	Converting agricultural land to more sustainable practices
Relevant SDG Goal	SDG 2 - Zero Hunger
Data/parameter	Area
Unit	Acres
Description (including Baseline Value) & Justification of relevance to SDG indicator	This project converts agricultural areas to more sustainable management practices. The project encourages adoption of these practices on farms that were not previously implementing them and therefore the baseline in relation to this specific project is 0. The outcomes of the project interventions directly relate to indicator 2.4.1, which is the proportion of agricultural area under productive and sustainable agriculture.
Source of data	Shapefiles
Value(s) applied	1527 acres converted
Measurement methods and procedures	Measured by summing the total acres of land converted to improved management practices.
Monitoring frequency	Annually
QA/QC procedures	Third party review

Corporate SD Contribution	Improving water quality
Relevant SDG Goal	SDG 6 - Clean Water and Sanitation
Data/parameter	Area
Unit	Acres converted
Description (including Baseline Value) & Justification of relevance to SDG indicator	This project converts agricultural areas to more sustainable management practices - in particular Conventional Till to No Till and No Cover Crops to Cover Crops (cereals and legume). The project encourages adoption of these practices on farms that were not previously implementing them, so the baseline is considered to be the NO3 leaching under the conventional practice. The analysis supporting this SDG was extrapolated from NO3 leaching estimates from published literature. The outcomes of the project interventions directly relate to target 6.6, which is protecting and restoring water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes
Source of data	Shapefiles
Value(s) applied	No of Acres converted to cover cropping and No Till
Measurement methods and procedures	Measured by summing the total acres of land converted to improved management practices - cover cropping and conservation tillage combined.
Monitoring frequency	Annually
QA/QC procedures	Third party review

10. Data Management System and Records

The program has established and applied quality management procedures to manage GHG data and associated information/documentation including the assessment of uncertainty. Using transparency and a well-documented model, the program has reduced as many uncertainties as possible that may be related to the quantification of GHG emission removals.

Copies (electronic and/or paper) of all survey data, data analyses, model runs, and documentation as well as estimates of the changes in carbon stocks; any GIS products; and copies of the measuring and monitoring reports are stored in secure databases. All processes and procedures are recorded and stored in databases, along with supporting documentation.

Figure 2 summarizes the annual cycle of technical assistance and data collection within the SHP network. Experienced field managers enroll farmers, support the farmer in designing the research project, and digitize plot layout and design. They coordinate soil sampling on each farm and are the primary point person for collection of yield and socioeconomic data. Data from participating farms are stored and analyzed in various formats and associated software (shapefiles, AgLeader SMS; management, soil, and survey data, Excel). Yield maps are sent to an external contractor for cleaning, validation, and analysis of strip-level yields. These diverse data sources are compiled to output data and documentation specific to the inset program. The data are used to run the DNDC model framework and outputs from the model are stored at EFC Systems in a database.

The data management system is run in accordance with Section 15 of the Framework on Data Management Systems and Collation of Evidence and attempts to meet each goal of the DMS while also meeting privacy and security requirements.

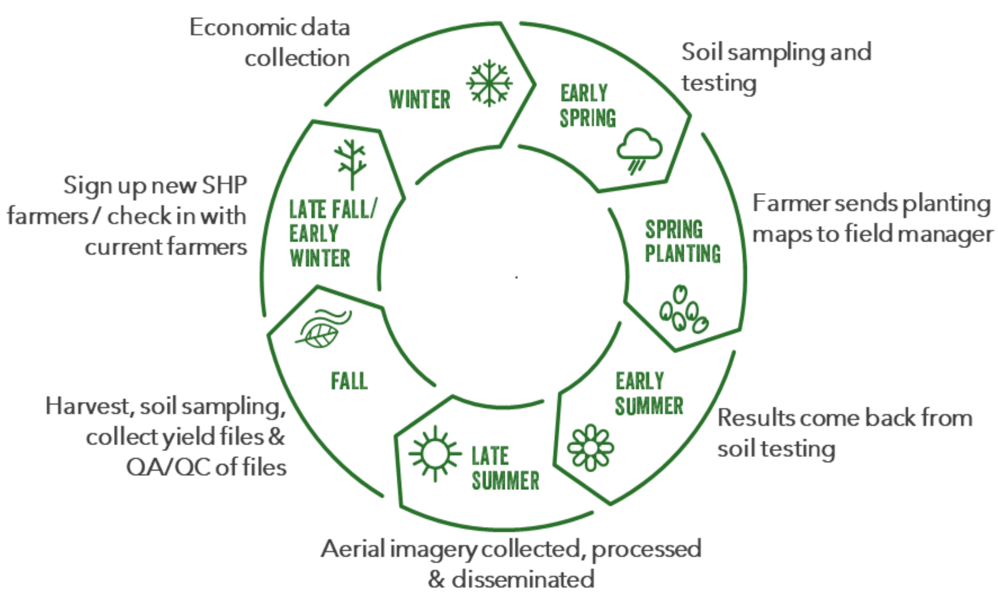


Figure 2: Data Collection Process

11. References

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12. Intervention Representative Signature

I am a duly authorized corporate officer of the intervention representative mentioned above and have personally examined and am familiar with the information submitted in this Inset Design Document, including the accompanying inset report on which it is based. Based upon reasonable investigation, including my inquiry of those individuals responsible for obtaining the information, I hereby warrant the submitted information is true, accurate, and complete to the best of my knowledge and belief, and that all matters affecting the validity of the emission reduction/removal claim have been fully disclosed.
The intervention representative has executed this Inset Design Document as of [Enter date].
Program Title: Charting a New Course – Carbon Insetting Program

Signature: Jeffrey Seale

Date: October 29, 2020
Name: Jeffrey Seale
Title: Director Climate Policy & Strategy, Bayer Crop Science