AGORO CARBON USA CROPLAND PROGRAM

Project title	Agoro Carbon USA Cropland Program
Project ID	3634
Crediting period	20/03/2021 to 19/03/2041
Original date of issue	28th November 2023
Most recent date of issue	11th November 2025
Version	3.3
VCS Standard Version	VCS 4.5
Prepared by	Agoro Carbon Alliance

CONTENTS

1 PROJECT DETAILS

1.1 Summary Description of the Project

The Agoro Carbon USA Cropland Program is a grouped VCS project implemented by Agoro Carbon Alliance (Agoro Carbon). The Program's geographic area is delineated by political borders of the USA (excluding Alaska and Hawaii) and includes only cropland. The initial project instances are in the following USA states: Colorado, Idaho, Illinois, Indiana, Minnesota, Nebraska, Oregon, South Dakota, Texas, Washington, and Wisconsin.

The Program will implement a package of regenerative agricultural land management activities. The Agoro Carbon USA Cropland Program will promote reduced and zero tillage, cover cropping, improved nitrogen (N) fertilizer management and potentially also other regenerative agricultural practices on cropland in the USA to reduce GHG and decarbonize agriculture. The implementation of these practices will lead to increases in carbon sequestration rates in the soil, reduced soil disturbance and soil erosion, improved crop residue and water management, as well as potentially reducing the total usage of fossil fuels.

The main objective of the Program is to provide the financial, agronomic, and educational support needed for farmers to adopt new farming practices that not only produce agricultural products in a sustainable and profitable way but also have a positive impact on climate change. During the project period, enrolled farmers will be assisted by the Agoro Carbon agronomic team to implement these project activities to transitioned from conventional to regenerative farming systems. Agoro Carbon's scientifically based program is designed to overcome existing barriers that otherwise prevent the adoption of improved land management practices. Through its carbon credit Program, Agoro Carbon provides farmers with financial incentives through the issuance of carbon credits.

The baseline practices are the "business as usual" agricultural management practices made by a farmer prior to implementing the practice changes associated with their participation in Agoro Carbon's Program. For each field within the project area, past management practices (i.e. tillage, planting, harvest, and fertilization events) over a three-year look-back period are recorded to determine the baseline scenario.

The project activity is following approved VCS methodology VM0042, Methodology for Improved Agricultural Land Management Version 2.0.

The project is anticipated to include ca. 1,813,249 hectares (ha) of cropland. Using conservative estimates, we estimated 301,746 tonnes CO2e per year of carbon removals and reductions to be achieved on average for the initial project instances.

Through project interventions, five different United Nations Sustainable Development Goals (SDGs) are addressed. They are as follows; SDG 2-Zero Hunger, SDG 4-Quality Education, SDG 6-Decent Work, SDG 9- Industry, Innovation and Infrastructure, SDG 13- Climate Action, and

SDG 15- Life on Land. Further information on our contributions to the United Nations Sustainable Development Goals can be found in section 1.18 Sustainable Development Contributions.

1.2 Audit History

Audit type	Period	Program	Validation/verification body name	Number of years
Validation	16-May-2023	VCS	Ruby Canyon Environmental/ TUV SUD	NA

1.3 Sectoral Scope and Project Type

Sectoral scope	14
AFOLU project category[1]	Agricultural Land Management (ALM)
Project activity type	Improved Cropland Management (ICM)

1.4 Project Eligibility

1.4.1 General eligibility

The grouped project is eligible under the scope of the VCS Program for the following reasons:

1. The project reduces GHG emissions which are included in the six accepted Kyoto Protocol greenhouse gases and accepted under the applied VCS methodology.
2. The project activity is following approved VCS methodology VM0042, Methodology for Improved Agricultural Land Management Version 2.0.
3. The project will implement a package of regenerative agricultural land management activities.
4. The project activity exclusively involves practices that constitute a change to historically common agricultural practices, which result in the sequestration, reduction and removal of greenhouse gases.
5. The project activity does not feature on the list of projects that are explicitly excluded project activities under the terms of Verra (VCS Standard, v4.5, Table 1).
6. The grouped project is eligible because it meets with the rules and requirements of the VCS Program criteria for GHG projects and programs.
7. The public comment period for this project was from 11th May 2023- 10th June 2023. The opening meeting with the VVB was the 16th May 2023. The start date of the project is the 20th March 2021. The project was listed on the project pipeline within

[1] *See Appendix 1 of the* VCS Standard

three years of the project start date, and the VVB opening meeting took place while the project was listed on the project pipeline as under validation, thus meeting all pipeline listing and validation deadlines set out in the VCS Standard, v4.6.

8. Initial PAIs have been established in the following states: Colorado, Idaho, Illinois, Indiana, Minnesota, Nebraska, Oregon, South Dakota, Texas, Washington, and Wisconsin.
9. The geographic boundaries of the PAIs have been established based on the geopolitical boundaries of the following US states: Colorado, Idaho, Illinois, Indiana, Minnesota, Nebraska, Oregon, South Dakota, Texas, Washington, and Wisconsin. Future PAIs may be added from any location within the identified geographic boundaries (states), provided they meet the eligibility requirements outlined in Section 1.4 and section 1.5.1. This also includes that the baseline scenario for the land unit aligns with the "business-as-usual" practices defined in Section 3.4 of the PD, and that the additionality criteria applied in Section 3.5 are met, regardless of the state. If new instances are identified that lie outside one of the identified states, a new geographic boundary must be created and validated to ensure it meets the baseline and additionality requirements of the project and methodology.

Eligibility criteria have been developed to ensure uniform application across geographies. As such, any future PAI added to the grouped project will be assessed against the same baseline conditions and additionality assessment as the initial PAIs. This ensures consistency in project implementation adherence to VCS rules and requirements across the entire project area.

The VVB will assess each future PAI addition in accordance with Sections 3.6.10 to 3.6.17 of the VCS Standard v4.6, confirming that eligibility, baseline consistency, and additionality have been properly demonstrated.

1.4.2 AFOLU project eligibility

VCS Sectoral Scope applicable to the project is Scope 14: Agriculture Forestry and Other Land Use (AFOLU). The Project activity is a grouped project and uses the VCS methodology: "VM0042, Ver 2.0, Methodology for Improved Agricultural Land Management" (ALM).

The project activity falls under Improved Cropland Management (ICM): This category includes practices that demonstrably reduce net GHG emissions of cropland systems by increasing soil carbon stocks, reducing soil N2O emissions, and/or reducing CH4 emissions.

The specific practices in our project are as follows:

1. Implementing Reduced Tillage/Improving Current Tillage Practices
2. Implementing Zero-Till/No-Till
3. Implementation of cover cropping
4. Implementation of improvement nitrogen management

1.4.3 Transfer project eligibility

Not applicable in this project scenario

1.5 Project Design

☐ Single location or installation

☐ Multiple locations or project activity instances (but not a grouped project)

☒ Grouped project

1.5.1 Grouped project design

The inclusion of new project activity instances into the Program will be eligible for the inclusion in this grouped project provided that they demonstrate applicability of the eligibility criteria below:

Criteria Number	VCS Requirement	Inclusion Criteria
1	Standard 3.6.16(1, 2), Standard 3.6.17 (4) Meth Applicability 1	The farmer has entered into a legal relationship with Agoro Carbon Alliance and signed the contract for enrollment into the Program. A new project instance must introduce or implement one or more new changes to pre-existing agricultural management practices as allowed in VM0042 v.2 such as e.g.- zero tillage, reduced tillage, nitrogen management or cover cropping.
2	Standard 3.6.16(1), Meth Applicability 2	In the case of practice(s) implementation which will introduce or implement quantitative adjustments (e.g., decrease in fertilizer application rate), such adjustment will exceed five percent of the pre-existing value, calculated as the average value over the historical look-back period, developed for the baseline schedule of activities.
3	Standard 3.6.16(1), Meth Applicability 3	Project activities of the project instance(s) must be implemented on land that is cropland at the project start date and remains cropland throughout the project crediting period.
4	Standard 3.6.16(1), Meth Applicability 3, 5	The project area of the project instance(s) must not have been cleared of native ecosystems within the 10-year period prior to the project start date.

5	Standard 3.6.16 (4), Standard 3.6.17 (1)	The project instance(s) shall occur within the geographic area defined in the project description and be defined using a unique geodetic polygon recorded as a KML/shape file and may be aggregated with multiple landowners. Factors relevant to the determination of the baseline scenario or demonstration of additionality will be assessed at a minimum, across the grouped project geographic area. No new instances will be added which overlap with any of the components of another AFOLU project's zone
6	Meth Applicability 6	The project activity of the project instance(s) is not expected to result in a sustained reduction of greater than 5% in productivity, as demonstrated by peer-reviewed and/or published studies on the activity in the region or a comparable region.
7	Meth Applicability 8	The project activity does not occur on wetlands.
8	Standard 3.6.16 (4)	The baseline of the project instance(s)s will be the continuation of pre-project agricultural management practices, which is the most plausible baseline scenario. Project practices have not been already implemented in the area enrolled in the Program within the past 3 years.
9	Standard 3.6.16 (3)	Carbon sequestration potential of the project instance(s), including estimation of the project baseline emissions, project emissions and leakage, will be done in the consistent manner using modeling and/or measurement approaches, as specified in the PD.
10	Standard 3.6.17 (3)	Project instance(s) will follow the Monitoring Plan established in the PD and meet the applicability criteria of VM0042 methodology.
11	Standard 3.6.16 (5)	To ensure new instances face the same baseline scenario, and therefore barriers to implementation identified in Section 3.5, farmers must be engaged in row-crop agriculture (specialty crops will not be included). Project instances will only be included after it is demonstrated that the inclusion of their project activities maintains or lowers the common practice score for the geographic area (state) they operate.
12	Standard 3.6.17 (7)	The farmer implementing project activity is not receiving and will not receive any other third-party or governmental Carbon Credits in exchange for undertaking the regenerative practices on the area submitted in the Program. The farmer also has not sold or transferred the carbon rights in relation to the implementation of the project activity(ies) to any third party and the project instance is not a part of any other carbon project. The project instance(s) will be not enrolled, or have been enrolled, in another VCS project.

13	Standard 3.6.17 (5,6)	Project instance(s)s will have a start date at the same date or later than the grouped project (i.e. the Program) start date. Project instance(s)s will be eligible for crediting from the later start date of the project activity instance or the start of the verification period in which they were added to the grouped project, through to the end of the total project crediting period.
14	Standard 3.6.18	Where inclusion of a new project activity instance necessitates the addition of a new project proponent to the project, such instances will be included in the grouped project description within five years of the project activity instance start date

Determination of baseline scenario and demonstration of additionality is based upon the initial project activity instances included in project description.

The project is a grouped project which may include multiple project activities. Multiple project activities may occur in any part of continental USA. New project instances will be included in the monitoring report with sufficient technical, financial, geographic, and other relevant information to demonstrate conformance with the applicable set of eligibility criteria and enable evidence gathering by the verification body. Also, for new project instances to be included in the project, the evidence of project ownership, in respect of each project activity instance, held by the project proponent from the respective start date of each project activity instance (i.e., the date upon which the project activity instance began reducing or removing GHG emissions) will be provided.

1.6 Project Proponent

Organization name	Agoro Carbon Alliance
Contact person	Christoher Chapman
Title	Interim Head of Carbon
Address	100 North Tampa Street Suite 3200, Tampa, United States, 33602
Telephone	+1 (888) 682-2726
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1.7 Other Entities Involved in the Project

This project is developed entirely by the Agoro Carbon Alliance. Agoro Carbon works with Soil Sampling groups and laboratories. We also work with regional “Channel Partners” that aid in our ongoing communication efforts with our farmers. A full list of our Channel Partners has been made available to the validation body.

1.8 Ownership

Agoro Carbon Alliance (hereafter "the Project Proponent") has the ownership and legal rights of the project activities. The project ownership consists of a "Carbon Credit Generation Agreement" whereby each farmer transfers title to the credits and the environmental attributes to Agoro Carbon. The Project Proponent has the ownership and legal right of developing and presenting the projects leading to the GHG emission reduction and removal, and each farmer has the legal right to control and operate the project activities occurring at farm level either via ownership, lease or other title to the land. This is demonstrated via an attestation of property rights attached to the Carbon Credit Generation Agreement, certification that is signed individually by each farmer.

Project ownership is proved by an enforceable and irrevocable agreement with the holder of the statutory, property or contractual right in the land, vegetation or conservation or management process that generates GHG emission reductions or removals which vests project ownership in the Project Proponent.

Thus, the project ownership is in line with VCS Standard, par. 3.7.1 6) An enforceable and irrevocable agreement with the holder of the statutory, property or contractual right in the land, vegetation or conservation or management process that generates GHG emission reductions or removals which vests project ownership in the project proponent.

At time of validation, this grouped project consisted of 235,204 acres across 1,440 fields managed by 89 farmers. Agoro Carbon has signed contracts with every farmer that is present in the project. Each farmer has the legal right to work their fields as Agoro Carbon only includes farmers who have this right.

1.9 Project Start Date

Project start date	20th March 2021
Justification	This date marks the day an enrolled farmer did not till his fields as he would in the baseline scenario. In the baseline scenario this farmer practiced conventional tillage.

1.10 Project Crediting Period

Crediting period	☐ Seven years, twice renewable ☐ Ten years, fixed

	☒ Other (The project activity instances included in the Agoro Carbon USA Cropland Program fall in the AFOLU project category 'ALM' (Agricultural Land Management). The project focuses on GHG emission removals through the sequestration of soil organic carbon (SOC), as well as emission reductions through the reduction of N2O, CH4 and/or fossil-derived CO2 emissions. For this reason, the project crediting period is 20 years, starting from 20/03/2021 up to 19/03/2041. This crediting period may be renewed four times with a total project crediting period not to exceed 100 years)
Start and end date of first or fixed crediting period	20-March-2021 to 19-March-2041

1.11 Project Scale and Estimated GHG Emission Reductions or Removals

Quantification of the potential GHG impact of regenerative agriculture is challenging due to heterogeneity in management practices and variation in the physical environment. The initial project instances include ca.95,186 hectares of cropland. Using conservative estimates, we estimated 301,746 tonnes CO2e per year of carbon removals and reductions to be achieved on average. This estimation was calculated based on average carbon sequestration potential for each farmer using recognized and well-known publicly available modelling tool COMET Planner (Available at: http://comet-planner-cdfahsp.com/) as well as calculations of emission reductions generated from nitrogen management reduction at the farm level.

As the project is continuously expanding with inclusion of new farmers, we estimate that the project will achieve more than 300,000 tCO2e/year emissions removals and reductions over the crediting period of 20 years renewable.

☐ < 300,000 tCO2e/year (project)

☒ ≥ 300,000 tCO2e/year (large project)

Calendar year of crediting period	Estimated GHG emission reductions or removals (tCO_2e)
2021	30,892
2022	39,287
2023	69,272
2024	99,257

2025	129,242
2026	159,227
2027	189,212
2028	219,197
2029	249,182
2030	279,167
2031	309,152
2032	339,137
2033	369,122
2034	399,107
2035	429,092
2036	459,077
2037	489,062
2038	519,046
2039	549,031
2040	579,016
2041	130,143
Total estimated ERRs during the first or fixed crediting period	6,034,921
Total number of years	20
Average annual ERRs	301,746

1.12 Description of the Project Activity

Agriculture, as an industry, accounts for an estimated 10% of the total U.S. greenhouse gas (GHG) emissions, including carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O) emissions (USDA-ERS). Climate change has the potential to adversely impact U.S. agricultural productivity at local and regional scales through alterations in rainfall patterns, more frequent occurrences of climate extremes (including high temperatures or drought), altered patterns of pest pressure, and changes in seasonal and diurnal temperature patterns. These impacts will affect national and international markets; the prices of food, fiber, and energy; agricultural incomes; and the environment.

While agriculture emits GHG, it also provides opportunities to reduce existing GHGs in the atmosphere. The Agoro Carbon USA Cropland Program will promote improved agricultural land management (IALM) practices, including reduced and zero tillage, cover cropping and improved nitrogen (N) fertilizer management on cropland in the USA as a means to reduce GHG and decarbonize agriculture. Practices will be implemented in row crop systems, which exclude ‘specialty crops’ as defined by the USDA. The implementation of these practices will lead to reduced soil disturbance and soil erosion, improved crop residue and water management, as well as potentially reducing the total usage of fossil fuels. These practices could, in turn, increase overall fertilizer and water use efficiency and potentially improve profitability at the farm level, whilst building resilience into farming systems. The project is a wide-ranging collaborative initiative between Agoro Carbon and farmers designed to channel carbon offset revenue to farmers and supporting those farmers with agronomic knowledge on regenerative practices.

The main objective of the Program is to provide the financial, agronomic and educational support needed for farmers to adopt new farming practices that not only produce agricultural products in a sustainable and profitable way, but also have a positive impact on climate change. During the project period, enrolled farmers will be assisted by the Agoro Carbon agronomic team to implement these project activities to transition from conventional to a regenerative farming system. Agoro Carbon’s scientifically based Program is designed to overcome existing barriers that prevent adoption of improved land management practices. The Agoro Carbon Program farmers have an opportunity to generate carbon credits as a financial means to support their practice changes. The Program is designed to expand over time and cover a range of farmers and farming activities in the USA to help drive the critical transition to a future dominated by resilient and sustainable agricultural systems.

Farmers who participate in the Program are required to adopt one or more changes to current agricultural management practices. A change constitutes adoption of a new practice (e.g., adoption of one of the pre-defined agricultural land management practices listed below in this section of this document), cessation of a pre-existing practice (e.g., conventional tillage) or adjustment to a pre-existing practice that could lead to GHG emissions reductions and/or an increase of carbon sequestration.

The Program is designed as a grouped project so that following the validation and registration, new farmers, provided that their activities meet the eligibility criteria defined in section 1.5.1 of this document, can continue to subscribe to the program. The initial project activity instances are located in the United States involving 79 farms on an area of roughly 95,184 hectares. This program operates in the contiguous United States, and it is not within a jurisdiction covered by a jurisdictional REDD+ program. This grouped project is continually adding instances. Below is an implementation schedule listing milestones and events to come for this project.

Date	Milestone(s) in the Project's Development and Implementation
20th March 2021	Project Start Date
01 April 2021- current	Grower Trainings
01 May 2021- current	Stakeholder Monitoring
01 May 2021- current	Natural Capital and Ecosystem Monitoring
19 Nov 2022	First Grower Appreciation Event held in West Texas
01 Nov 2023	Second Grower Appreciation Event held in Oregon
6 Feb 2024	Third Grower Appreciation Event held in South Dakota
11 May 2023	Public Comment Period Starts for VCS project begins
5 May 2023	Initial Kickoff Meeting between Ruby Canyon and Agoro Carbon Alliance for VCS validation
18 Sep 2023	VCS validation site visit conducted by Ruby Canyon Engineering
15 Apr 2024	Initial Kickoff Meeting between SCS Global Services and Agoro Carbon for SD VISta validation
18 – 28 Jun 2024	Site Visit dates for SD VISta Validation
June 2025	Planned first VCS and SD VISta verification
Rolling Basis	Sign up additional farmers

The project activity includes the implementation of the following types of regenerative agricultural practice(s) by the farmers:

<u>Type 1. Implementing Reduced Tillage/Improving Current Tillage Practices</u>

<u>Overview of Implementing Reduced Tillage/Improving Current Tillage Practices</u>

The vast majority of farmers in the United States practices some form of conventional tillage that results in a significant amount of soil disturbance, and thereby an increased CO2 influx to the atmosphere. Reducing tillage mitigates these negative effects of tillage while improving the long-term soil health for the farmer. This improved agricultural practice includes one of the key concepts as outlined by USDA-NRCS for improving soil health and carbon sequestration, and it involves the reduction of soil disturbance (usually shallow and without full soil inversion) from farmers' existing tillage practice (e.g. conventional tillage to reduced tillage). This includes reduction in the number of tillage passes, reduced tillage depth, strip-till, and no-till to reduce overall soil disturbance.

Farmers participating in the program to change their current tillage practices to reduced/improved tillage to sequester soil organic carbon which will in turn improve soil health. The combination of returning crop residues to the soil and reduced soil disturbance, in the long term, improves the carbon content of the soil and thereby improves soil fertility, soil structure, and water-holding capacity. New technology is needed for implementation of this practice, specifically equipment such as strip-till implements or chisel plows to disturb the soil less intensely compared to conventional tillage methods. This project activity is implemented amongst the initial project activity instances

Detailed Practice Description

Reducing soil disturbance to increase year-round surface residue and decrease the degree of soil inversion, mixing, lifting, fracturing or compressing that occurs as a regular part of field activities during the contract period. This can be measured by proposed decreases in Soil Tillage Intensity Rating (STIR) or Soil Conditioning Index (SCI), or mixing efficiency; whereby mixing intensity pre-estimates can be assigned based on the mixing efficiency and depth of all tillage operations, as referenced by TAMU (2019). Any reduction in tillage system intensity should fall at or below 0.144, based on the provided tillage intensity calculator.

Type 2. Implementing Zero-Till/No-Till

Overview of Implementing Zero-Till/No-Till

No-till or zero till is defined as the absence of tillage operations from harvest of the previous crop to harvest of the current crop. Minimal soil disturbance only happens at the time of planting without overturning the soil. As a result, we recommend to farmers who participate in the Project to implement no-tillage to avoid 1) a separate band application of fertilizer, 2) mechanical cover crop termination (apart from crimping), 3) tillage to suppress weeds or incorporate residue. Tillage can be implemented for remediating rutted wheel track areas created by irrigation systems. When implementing this project activity, there is a need for specialized equipment such as no-till planters or drills capable of planting seeds directly into untilled soil. This equipment often is not owned by farmers in the baseline scenario. This project activity is implemented amongst the initial project activity instances.

Detailed Practice Description

The complete absence of any primary or secondary tillage practices with the objective of leaving the soil undisturbed during the entire year. No-till planters with associated residue managers, finger coulters and double disk openers that move residue and improve seed-to-soil contact are allowable disturbances as are grain drills with wavy coulters ahead of the seed tube. Fertilizer applicators, such as trailer or tractor mounted anhydrous or liquid fertilizer injection, that use similar means to place fertilizer shallowly in the soil profile are also allowed disturbances. Residue management is not defined but a high amount of residue on the surface decreases erosive forces of wind and water, increases soil organic matter, improves water infiltration and moisture retention.

Type 3. Implementation of cover cropping

Overview of Implementation of cover cropping

Planting cover crops effectively sequesters soil organic carbon in addition to improving soil health and water quality. Cover crops are usually planted to protect the soil, retain soil moisture, recycle residual nutrients, and sequester carbon rather than for the purpose of being harvested; although they could also potentially be harvested via livestock grazing, which would further enhance carbon sequestration. Cover crops can include grasses, brassicas, legumes, and other broadleaf species, and can be annual or perennial plants. Popular cover crops include cereal rye, clover, vetch and oilseed radish, they can be mono or polyculture (mixture of many species).

By joining Agoro Carbon USA Cropland Program, farmers are required to plant cover crops to increase soil organic carbon stocks and the reduction of net N2O emissions if, depending on the cover crop species, a grower can reduce the amount of synthetic-N fertilizer applied. Leguminous cover crops can fix atmospheric-N and, along with brassica cover crops, provide an optimal ratio of carbon to nitrogen so that their decomposed residues add to the plant-available nitrogen pool. The use of equipment such as seed drills and or broadcast spreaders is used for planting cover crop seeds. These seed drills and broadcast spreading methods often times differ from the seeding methods used by farmers in the baseline scenario, thus leading to the need to purchase further equipment. This project activity is implemented amongst the initial project activity instances

Detailed Practice Description

Planting of a grass, legume or other broadleaf species either singly or in combination between cash crops or in a period that would have otherwise been fallow to promote soil health or other agronomic or economic benefits in addition to carbon sequestration where this has historically not been the practice. Implemented rates are to be accompanied by publicly accessible guidance published by seed provider or university extension. The growing season should be sufficient to allow biomass accumulation.

Type 4. Implementation of Nitrogen management

Overview of Implementation of Nitrogen management

Managing nitrogen application rates lowers N2O emissions to the atmosphere and contributes to an overall reduction of GHG emissions. Agriculture plays a major role in N2O emissions, because of nitrogen fertilizer application. The application of N fertilizers increases available nitrogen, which enhances both nitrification and denitrification rates increasing the production of N2O. The reduction of synthetic and/or organic nitrogen fertilizer application therefore results in a substantial net reduction of N2O emissions. To qualify for a nitrogen rate reduction in the program, a grower needs to demonstrate a reduction in their nitrogen rate from baseline.

Nitrogen management requires the use of new technologies and equipment such as precision agriculture equipment like variable rate application systems to precisely apply nitrogen fertilizers based on soil nutrient data. This technology typically involves GPS-guided equipment that can automatically adjust application rates in real-time, optimizing resource usage and maximizing crop yield while minimizing environmental impact. This project activity is implemented amongst the initial project activity instances.

Detailed Practice Description

A reduction in the rate of synthetic and/or organic nitrogen fertilizer application below a documented historical baseline to decrease nitrous oxide (N_2O) emissions and improve nitrogen use efficiency. This practice must be supported by publicly available guidance from a university extension or certified agronomic source and may include the adoption of precision agriculture technologies, such as variable rate application systems, GPS-guided equipment, or in-season decision tools based on soil or crop data. All nitrogen sources must be accounted for, and implementation must represent a change from prior practice. The goal is to reduce available nitrogen that drives N_2O emissions through nitrification and denitrification, while maintaining crop productivity.

Table 1-1 - Practices Implemented by State

	Reduced/Improved Tillage	No Till	Cover Cropping	Nitrogen management
Colorado	✓			✓
Idaho	✓	✓	✓	✓
Illinois	✓	✓	✓	✓
Indiana	✓	✓	✓	
Minnesota	✓		✓	✓
Nebraska	✓	✓	✓	✓
Oregon		✓		✓
South Dakota	✓			✓
Texas		✓	✓	✓
Washington	✓	✓	✓	✓
Wisconsin		✓	✓	✓

The other entities in our project include the following groups mentioned in section 1.7 of this project description; channel partners, soil samplers, and soil testing laboratories. Channel partners aid in our ongoing communication efforts with our farmers. These efforts include aiding Agoro Carbon to find new and eligible farmers to include in this grouped project, help in collection of baseline and project activity data, and if qualified to do so, aid in providing agronomic advice. Soil samplers take soil samples to test measure baseline and project level SOC levels. They take these samples in Agoro Carbon pre-stratified soil sampling locations . They then send the samples to laboratories, the third entity involved, to measure the level of SOC amongst other soil characteristics . All entities will carry out their level of involvement throughout the project's crediting period.

The project's crediting period is 20 years, starting from the 20th of March 2021, lasting until the 19th of March 2041. This crediting period may be renewed four times with a total project crediting period not to exceed 100 years. All enrolled farmers enter into a contract with Agoro Carbon that allows Agoro Carbon to monitor their enrolled fields for 40 years.

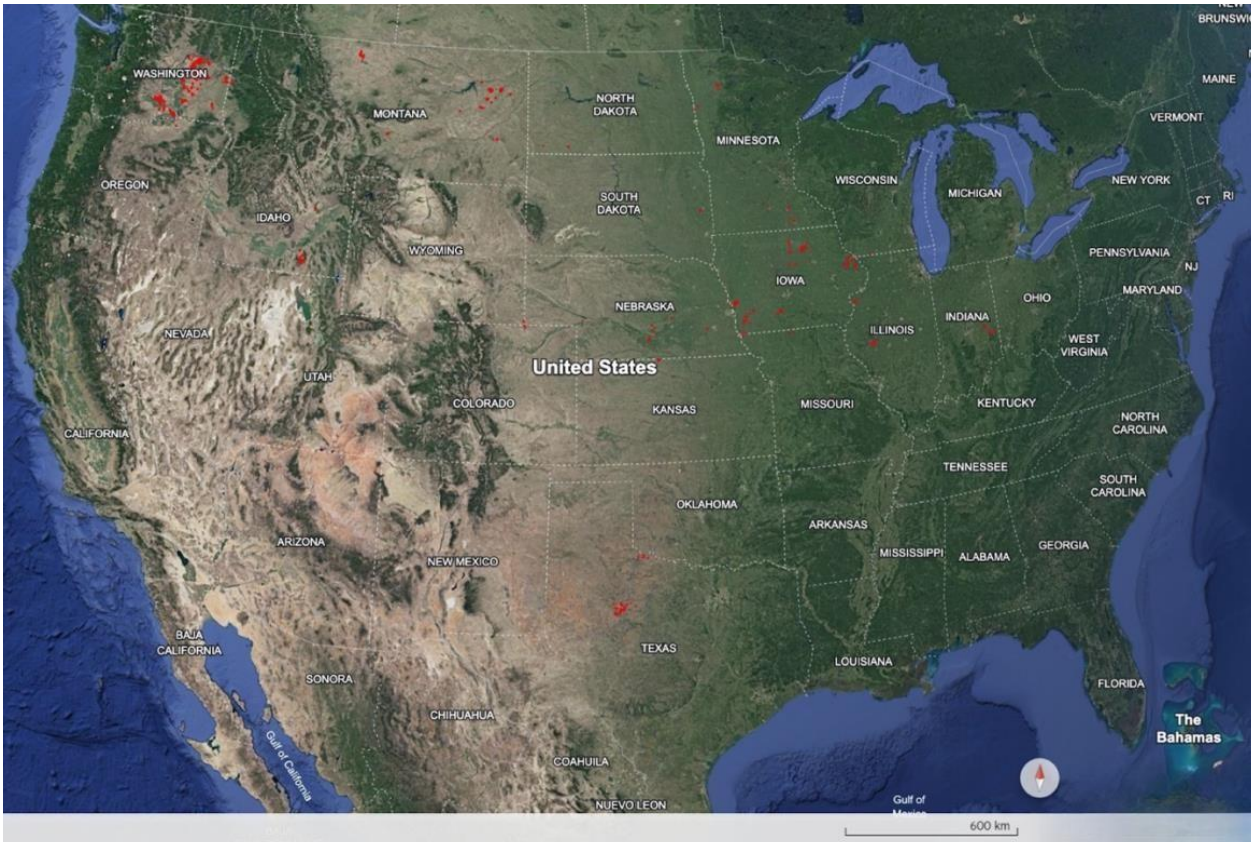
Based on the team’s agronomic experience, we believe that it is highly unlikely that a farmer would revert back to old practices after the 10-year period and contract expiration. The key to the permanence of practice implementation, and therefore the associated SD benefits, is ensuring farmers have the support to continue the practices for the first years. The incentives and support to ensure farmers continue their transition to regenerative agriculture are highlighted in the section above. For a more detailed view of benefit permanence, please see the Monitoring Plan in section 5.3.

Each of these practices will be implemented by growers that have, in most cases, decades of agricultural experience. Following the appropriate guidance from Agoro GST representative or trusted advisors, growers will be given the freedom to implement the practices as they see fit to suit their conditions as long as it meets the definition of the practice listed above

The level in which practices are carried out are intended to remain the same throughout the project crediting period. However, due to climatic variability, market conditions, and a myriad of other reasons the frequency, intensity, etc., of practices may fluctuate. For example, tillage may be necessary for a no-till grower if compaction occurred during an unusually wet harvest. After abundant rainfall growers in the Pacific Northwest may choose to plant a cover crop even though they had no intention of doing so when they began. A reduced tillage grower may see the benefits of the practice and decided to transition to no-till. Each practice is likely to see some degree of variability in execution over the project lifetime. In most cases it is expected that variability will be temporary in which growers will deviate from their implementation plan, but then revert back to the implementation plan after conditions have returned to normal. We expect that deviations from implementation plans will likely follow geographic patterns, based on climatic and environmental conditions. Each activity mentioned in this section are implemented in the states indicated in the table above.

1.13 Project Location

The geographic boundaries of the PAIs have been established based on the geopolitical boundaries of the following US states: Colorado, Idaho, Illinois, Indiana, Minnesota, Nebraska, Oregon, South Dakota, Texas, Washington, and Wisconsin. Future PAIs may be added from any location within the identified geographic boundaries (states), provided they meet the eligibility requirements outlined in Section 1.4 and section 1.5.1. This also includes that the baseline scenario for the land unit aligns with the “business-as-usual” practices defined in Section 3.4 of the PD, and that the additionality criteria applied in Section 3.5 are met, regardless of the state. If new instances are identified that lie outside one of the identified states, a new geographic boundary must be created and validated to ensure it meets the baseline and additionality requirements of the project and methodology.



1.14 Conditions Prior to Project Initiation

The baselines practices are the “business as usual”, agricultural management practices made by the farmer prior to implementation of improved agricultural land management practices. These include, but are not limited to, conventional nitrogen fertilizer and tillage management practices and the absence of cover cropping. For each field within the project area, past management practices (i.e. tillage, planting, harvest, and fertilization events) over a three-year look-back period are recorded in order to determine the baseline scenario. Baseline emissions/stock changes are then modeled or (for SOC stock change only) directly measured in the subject to the scheduled activities. The crops and practices assumed in the baseline scenario are re-evaluated as required by the VCS Standard and revised, if necessary, to reflect current agricultural production in the regions.

Topography

The geographic map of the project area is presented below:

Climate

Due to its large size and wide range of geographic features, the United States contains examples of nearly every global climate. The climate is subtropical in the southern United States, semiarid in the Great Plains west of the 100th meridian, Mediterranean in coastal California and arid in the Great Basin, parts of the Northwest, and the Southwest.

The Great Basin and Columbia Plateau (the Intermontane Plateaus) are arid regions that lie in the rain shadow of the Cascades and Sierra Nevada. Precipitation averages less than 15 inches (38 cm). The Southwest is a hot desert, with temperatures exceeding 100 °F (37.8 °C) for several weeks at a time in summer. The Southwest and the Great Basin are also affected by the monsoon from the Gulf of California from July to September, which brings localised but often severe thunderstorms to the region.

Much of California, particularly the agriculture-rich Central Valley, consists of a Mediterranean climate, with occasional excessive rainfall from October to April and nearly no rain the rest of the year. In the Pacific Northwest rain falls year-round, but is much heavier during winter and spring. The mountains of the west receive abundant precipitation and very heavy snowfall. The Cascades are one of the snowiest places in the world, with some places averaging over 600 inches (1,524 cm) of snow annually, but the lower elevations closer to the coast receive very little snow.

Florida has a subtropical climate in the northern part of the state and a tropical climate in the southern part of the state. Summers are wet and winters are dry in Florida. Annually, much of Florida, as well as the Deep South, are frost-free. The mild winters of Florida allow a massive tropical fruit industry to thrive in the central part of the state, making the US second to only Brazil in citrus production in the world.

Hydrology

The United States has an extensive inland waterway system, much of which has been improved for navigation and flood control and developed to produce hydroelectricity and irrigation water. Some of the world's largest dams, artificial lakes, and hydroelectric power plants are on U.S. rivers. The Mississippi-Missouri river system (3,890 mi/6,300 km long), is the longest in the United States and the second longest in the world. With its hundreds of tributaries, chief among which are the Red River, the Ohio, and the Arkansas, the Mississippi basin drains more than half of the nation. The Yukon, Columbia, Colorado, and Rio Grande also have huge drainage basins.

Other notable river systems include the Connecticut, Hudson, Delaware, Susquehanna, Potomac, James, Alabama, Trinity, San Joaquin, and Sacramento.

The major river system in the United States is that formed by the Mississippi and its two major tributaries, the Ohio and Missouri rivers. This giant network drains about 41 percent of the 48state area, including all or part of 31 states (and two Canadian provinces). The combined Missouri-Mississippi River is about 3,700 miles (5,970 kilometres) long, a distance surpassed only by the Nile and Amazon rivers. Barges can navigate the rivers upstream to Minneapolis-St. Paul, Minnesota; Pittsburgh, Pennsylvania; and Sioux City, Iowa. New Orleans, Louisiana, located near the mouth of the Mississippi, was one of the nation's leading seaports before Hurricane Katrina's devastating blow in 2005.

Dependence on a river is illustrated by current problems along the Missouri. Severe drought during the first decade of the twenty-first century has caused the river's flow to reach a critically low level. Recreational use, hydroelectric energy production, barge traffic, and even the domestic water supply of some riverside communities has been severely affected as a result.

Many Eastern rivers are of local importance. The Hudson River has played a very significant role in the growth of New York City. In the Southeast, the Tennessee, Cumberland, and other rivers were transformed by one of the world's most massive reclamation projects. Beginning in 1933, during the Great Depression, the Tennessee Valley Authority (TVA) built nearly 50 dams on this drainage system. Their construction spurred the regional economy by creating jobs for tens of thousands of people in one of the nation's poorest regions. The dams also gave the area a clean and inexpensive source of energy(hydroelectric), controlled flooding that had long plagued the region, and created reservoirs that provide many recreational opportunities.

In the Southwest, the Rio Grande and Colorado Rivers flow southward across desert landscapes. Both streams are of far greater importance than their relatively small volume of water might suggest. In fact, millions of people, huge cities, and billions of dollars in agricultural production depend on their flow. The Rio Grande flows from the Colorado Rockies, through central New Mexico, and into Texas, where it forms the border between the United States and Mexico.

The Colorado River is controlled by eight dams and reservoirs, including Glen Canyon Dam and Lake Powell on the Utah-Arizona border and Hoover Dam and Lake Mead just east of Las Vegas, Nevada. Huge water diversion projects have artificially supported the Southwest's booming population and economic growth. Phoenix and Tucson, Arizona, draw water from the Colorado River, as do California's Los Angeles basin, San Diego, and the agriculturally productive Imperial Valley. Las Vegas, the nation's fastest-growing city, also depends on Colorado for its water supply. Coastal southern California also obtains water from streams that flow from the Sierra Nevada.

The Great Salt Lake and Alaska's Iliamna are the largest U.S. lakes outside the Great Lakes and Lake of the Woods, which are shared with Canada (Lake Michigan and Iliamna are the largest freshwater lakes entirely within the United States). The Illinois Waterway connects the Great Lakes with the Mississippi River, and the New York State Canal System links them with the Hudson.

In many parts of the country, competing demands for water create stress in local and regional watersheds. The map below shows a “water supply stress index” for the U.S. based on observations, with widespread stress in much of the Southwest, western Great Plains, and parts of the Northwest. Watersheds are considered stressed when water demand (from power plants, agriculture, and municipalities) exceeds 40% (water supply stress index of 0.4) of available supply.

Soil types

Soils are the product of climate, organisms and topography, acting on parent (geologic) material over time. Thus the great diversity of geologic materials, geomorphic processes, climatic conditions, biotic assemblages and land surface ages in the United States is responsible for the presence of an enormous variety of mineral and organic soils.

The US soil taxonomic hierarchy includes orders, suborders, great groups, subgroups, families and series, with each series representing a unique kind of soil. In the United States, over 19,000 soil series have been identified.

Ecosystems

In the United States a list of ecoregions has been developed by the U.S. Environmental Protection Agency (EPA) and the Commission for Environmental Cooperation (CEC). The Commission's 1997 report, Ecological Regions of North America, provides a framework that may be used by government agencies, non-governmental organizations, and academic researchers as a basis for risk analysis, resource management, and environmental study of the continent's ecosystems. In the United States, the EPA and the United States Geological Survey (USGS) are the principal federal agencies working with the CEC to define and map ecoregions. Ecoregions may be identified by similarities in geology, physiography, vegetation, climate, soils, land use, wildlife distributions, and hydrology.

The classification system for ecoregions has four levels, but only Levels I and III are shown on this list. Level I divides North America into 15 broad ecoregions; of these, 12 lie partly or wholly within the United States.

Agricultural Land Use

Although agricultural activity occurs in every state in the USA, most of the cultivated cropland (excluding California) is concentrated in three major regions of the U.S: 1) the Corn Belt (Iowa, Illinois, Indiana, Kansas, Kentucky, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, and South Dakota), 2) the Wheat Belt (Colorado, Kansas, Oklahoma, Oregon, Montana, Nebraska, Texas, Idaho, and Washington) 3) the Cotton Belt (Alabama, Arkansas, Georgia, Louisiana, Mississippi, Oklahoma, North and South Carolina, Tennessee, Texas) where cotton and rice are the major crops grown along with few other miscellaneous crops. The corn belt, which is located in the midwest region of the U.S., is characterized by having a combination of the most productive soils (i.e.fertile mollisols) and favourable climatic conditions in the U.S for growing corn and soybean. The most recent USDA survey data indicates around 91 million acres are devoted to corn production and 83 million acres to soybean each year in this region, with these two crops typically grown in a 2-year rotation of alternating corn and soybean planting. These two crops are grown primarily under rain-fed conditions in the eastern corn belt and irrigated conditions in the west (i.e. Kansas and Nebraska).

The soils in the western Wheat belt states are, in general, less productive than those in the corn belt and climate conditions are more arid and water-limited; both of which limit crop yields. There are around 44 million acres devoted annually to either spring or winter wheat production, with spring wheat production primarily located in the northern states (i.e. Montana and North Dakota).

The soils of the southern Cotton belt are in general highly weathered due to excessive precipitation and, hence, are less productive than the Corn belt soils. Most of the crops produced in this region are grown under rainfed conditions. Cotton is planted on around 12 million acres and rice is grown on 3 million acres annually.

1.15 Compliance with Laws, Statutes and Other Regulatory Frameworks

The Agoro Carbon USA Cropland Program is designed and implemented in compliance with all applicable local, state, and federal laws, statutes, and regulatory frameworks (“Applicable Laws”). The Project Proponent has further determined that the activities and approaches of the proposed project are not prohibited by any Applicable Law.

All farmers participating in the project agree and are contractually obligated to comply with any Applicable Laws relevant to that farm. The Applicable Laws applicable to any given farm may include, without limitation, those related to: labor and employment, land use, water use, protection of the environment, and others. Relevant environmental laws that may apply to individual farms, depending on activity, may include:

1. Clean Air Act (CAA) and state equivalents
2. Clean Water Act (CWA) and state equivalents, including wetlands protection requirements
3. Endangered Species Act (ESA) and state equivalents
4. Migratory Bird Treaty Act (MBTA)
5. Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and similar state laws governing chemicals
6. Federal Food, Drug, and Cosmetics Act (FFDCA)

Each farm has a legal obligation to comply with any Applicable Laws, as well as a contractual obligation with the Project Proponent to adhere to and comply with Applicable Laws.

There are no laws, regulations, or other requirements at the federal, state, or local level that require the adoption and implementation of the regenerative agriculture and other practices contemplated by this Project. As a result, the Program can demonstrate a regulatory surplus in accordance with VCS requirements.

1.16 Double Counting and Participation under Other GHG Programs

1.16.1 No Double Issuance

Is the project receiving or seeking credit for reductions and removals from a project activity under another GHG program?

☐ Yes ☒ No

1.16.2 Registration in Other GHG Programs

Has the project registered under any other GHG programs?

☐ Yes ☒ No

1.16.3 Projects Rejected by Other GHG Programs

Has the project been rejected by any other GHG programs?

☐ Yes ☒ No

1.17 Double Claiming, Other Forms of Credit, and Scope 3 Emissions

1.17.1 No Double Claiming with Emissions Trading Programs or Binding Emission Limits

Are project reductions and removals or project activities also included in an emissions trading program or binding emission limit? See the *VCS Program Definitions* for definitions of emissions trading program and binding emission limit.

☐ Yes ☒ No

1.17.2 No Double Claiming with Other Forms of Environmental Credit

Has the project activity sought, received, or is planning to receive credit from another GHG-related environmental credit system? See the *VCS Program Definitions* for definition of GHG-related environmental credit system.

☐ Yes ☒ No

1.17.3 Supply Chain (Scope 3) Emissions

Do the project activities specified in Section 1.12 affect the emissions footprint of any product(s) (goods or services) that are part of a supply chain?

☒ Yes ☐ No

If yes:

Is the project proponent(s) or authorized representative a buyer or seller of the product(s) (goods or services) that are part of a supply chain?

☐ Yes ☐ No

If yes:

Has the project proponent(s) or authorized representative posted a public statement on their website saying, “Carbon credits may be issued through Verified Carbon Standard project [project ID] for the greenhouse gas emission reductions or removals associated with [project proponent or authorized representative organization name(s)] [name of product(s) whose emissions footprint is changed by the project activities].”

☐ Yes ☒ No

1.18 Sustainable Development Contributions

The United States supports the United Nations Sustainable Development Goals by providing technical assistance and monetary support throughout the world. Though the United States supports these goals, they don’t have any national SDG priorities themselves. That said, the

USDA has recently set forth new priorities that our suite of activities are in fact addressing. The four new priorities are as follows:

1. Advancing Racial Justice, Equity, Opportunity, and Rural Prosperity
2. Addressing Climate Change via Climate-Smart Agriculture, Forestry, and Clean Energy
3. Tackling Food and Nutrition Insecurity
4. Creating More, Better, and New Market Opportunities

Our projects here at the Agoro Carbon Alliance are addressing priorities 1 and 2 by providing another income stream via carbon finance and sign on bonuses, the implementation of sustainable farming practices, and the advancement of agronomic knowledge across all of our enrolled growers. Monitoring and reporting our projects contributions to these nationally stated sustainable development priorities will be done by our standard monitoring and reporting efforts in the project scenario. Any and all changes and developments will be documented in project documentation as well as an accompanying SD VISta project.

Below is a table encompassing the SDGs our project is addressing.

Row number	Estimated Project Contribution by the End of Project Lifetime	SDG Target	SDG Indicator	Assessment
1)	The project will increase agronomic knowledge and experience of all participants by providing new learning opportunities coupled with direct agronomic support. At time of validation, 79 farmers are enrolled and are benefiting from these additional resources.	4.4	Proportion of farmers with the knowledge and skills to implement more sustainable agricultural practices.	Taking account of the number of growers enrolled now receiving training and agronomic advice that otherwise would not have been in the absence of our program.
2)	The project will provide a diversified revenue stream and or add value to an existing revenue stream for farmers.	2.3	Diversified and or increased revenue streams for farmers.	Taking account of the number of growers enrolled now receiving additional revenue

	The intention being that over time farmers can fetch a higher price for their yields due to an increase in demand for reduced carbon products.			streams (direct carbon payments).
3)	95,184 hectares currently enrolled and implementing sustainable agricultural practices.	2.4	Proportion of agricultural area under productive and sustainable agriculture	Taking account of number of hectares enrolled.
4)	6,034,921ERRs over project lifetime by implementing new sustainable agricultural practices.	13.0	Tonnes of greenhouse gas emissions avoided or removed	Updating of ERRs throughout project lifecycle and continuous monitoring of practice implementation.
5)	Increase in hectares now utilizing regenerative agricultural practices.	13.1	Increase resiliency to draught and fire hazards of agricultural ecosystems	Taking account of number of hectares enrolled.
6)	Increase in hectares now utilizing regenerative agricultural practices.	15.3	Restore degraded soil	Taking account of number of hectares enrolled.
7)	Increase in value added per new practice as measured by tonnes of C02.	9.4	By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and	Updating of ERRs throughout project lifecycle and continuous monitoring of practice implementation.

			environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities.	

1.19 Additional Information Relevant to the Project

1.19.1 Leakage Management

It is not expected that the project will cause GHG emissions to change outside of the project boundary because of the adopted practices or changes to existing practices. Any potential leakage for the project boundaries will be accounted for according to VM0042 v2.0 Section 8.4.1.

1.19.2 Commercially Sensitive Information

Verra Program Definitions v4.1 defines "Commercially Sensitive Information" as the following;

"Trade secrets, financial, commercial, scientific, technical or other information whose disclosure could reasonably be expected to result in a material financial loss or gain, prejudice the outcome of contractual or other negotiations or otherwise damage or enrich the person or entity to which the information relates."

Exact addresses, names, and financial information of project participants will not be disclosed. Release of this information can be damaging for a number of reasons. Farmers enrolled in our Program prefer their anonymity and privacy. Disclosing their address, names, and financials may bring about unwanted solicitations, and the potential for theft of new equipment and seed if the fact they now have ownership is broadcasted. Full details have been given to the VVB.

1.19.3 Further Information

The Agricultural space in the United States contains a patchwork of various state and private entities all vying for influence. As stated in our additionality section, a lot of these programs tend to miss the mark in their overall efficacy, either being overly burdensome on the farmers already busy implementation schedules and budgets. There are also other project developers in the United States at this time developing projects using this methodology. The Agoro Carbon Alliance takes double counting and our additionality approach incredibly seriously, and continuously works to ensure that our enrolled hectares are in fact additional and there is no double counting occurring. We vet and interview all new farmers wanting to enroll into our Program, against our eligibility criteria, which clearly states that their involvement in another GHG program is prohibited.

2 SAFEGUARDS AND STAKEHOLDER ENGAGEMENT

2.1 Stakeholder Engagement and Consultation

2.1.1 Stakeholder Identification

Use the table below to describe the stakeholder identification process. Where the rows do not apply, provide justification in the cell in the table below.

Stakeholder Identification	Our farmers hear about Agoro Carbon through multiple channels including radio and internet advertisements, trade shows, local events that Agoro Carbon participates in, channel partners and most commonly, word of mouth from other farmers. Once interested farmers are identified, Agoro Carbon then identifies individuals associated with the farmers that could be impacted by the implementation of the Program. Once a grower has agreed to participate in the Agoro Carbon Program, identification of secondary stakeholders is conducted through conversations with our farmers and channel partners. We've identified all individuals who will be affected by our project, upstream and downstream. These stakeholders are as follows: 1. Project Participants and their families 2. Channel Partners 3. Soil Samplers 4. Local Agronomists
Legal or customary tenure/access rights	Growers in the project have legal access and rights to their land and the products from it through direct ownership or lease agreement. This is demonstrated via an attestation of property rights attached to the Carbon Credit Generation Agreement, certification that is signed individually by each farmer.

	Farmers enrolled in our program that are living within the boundaries of a Federal Indian Reservation must demonstrate that they have consent from relevant tribal authorities to carry out project activities and receive payment from the Agoro Carbon Alliance for doing so. Project activities are not limited to project interventions, they include scheduled soil sampling, and check-ins from our Grower Success Team.
Stakeholder diversity and changes over time	The project area spans across 16 states which have varying compositions of social, economic, and cultural diversity. There is also great diversity in farm size and crop type. Though stakeholders may come from varying background, they all work in and around the agriculture space. The diverse makeup of different social, cultural, and economic norms will not change in the project scenario. Through participation in our project, growers' networks are broadened. They will meet and work with members of the Agoro Carbon Alliance team, as well as opportunities to meet other growers and their families, channel partners, soil samplers, and further their communication with their local agronomist.
Expected changes in well-being	Implementation of project interventions bring about a myriad of ecosystem services through an increase in biodiversity richness and abundance associated with project interventions. This includes increases in avian and insect populations that provide ecosystem services like pollination and serve as proxies to overall ecosystem health. No-till farming minimizes soil disturbance, allowing for a more diverse microbial ecosystem to develop and thrive, which supports a wider range of plant and animal species. Cover cropping introduces additional plant species into agricultural rotations, providing habitats and food sources for various organisms, thereby increasing both the richness and abundance of biodiversity in the project area. Additionally, farmers are to expect an increase in revenue through direct carbon payments.
Location of stakeholders	The project includes multiple locations or project activity instances and is developed as a grouped project. Stakeholders live within and adjacent to project boundaries. They often live in communities already dominated by agriculture. Project areas include 16 different states as well as two federally recognized Indian

Location of resources	Reservations; the Cheyenne River Indian Reservation in South Dakota and the Coeur d'Alene Reservation in Idaho. Agoro Carbon does not own or control the land on which the project operates and relies on the voluntary participation of farmers to implement sustainable agricultural practices which reduce and remove GHG emissions. Resources are located directly on farms, in fields that are included in the project boundary.

2.1.2 Stakeholder Consultation and Ongoing Communication

Date of stakeholder consultation	01-May-2021 onwards; First "Grower Appreciation Event" held 19 November 2022. Subsequent Grower Appreciation Events held 3 February 2024
Stakeholder engagement process	Before practice implementation occurs, stakeholders can speak with Agoro Carbon staff agronomist about their individual fields enrolled and the various nuances related to them. Farmers for most of the time are implementing the practices themselves. If the farmers themselves aren't the ones implementing the practice, it's individuals they've hired themselves to do it on their behalf. This is where costs are discussed. Additional pieces of equipment, types of seed, fertilizer, labor, etc. is discussed and recommendations on where and how to purchase these inputs are given, though often this knowledge is already something understood and acted upon. At least annually, farmers meet with Agoro Carbon staff agronomists to check in on their practice implementation and give feedback. They'll have the opportunity to give feedback directly to Agoro this way. In these instances, feedback on implementation, contract terms, and ideas for other practices are heard and recorded in Salesforce. With this understanding, the largest area in which a stakeholder can influence broader project design is through feedback on the contract they sign with Agoro Carbon, specifically regarding the incentives they receive for practice implementation. Since project start, there have been a total of 16 contract iterations. Before the onset of the project, Agoro Carbon conducted stakeholder workshops and surveys on the contract design. These workshops

	and surveys were conducted with existing and potential growers to ensure the incentives were amenable. These workshops and surveys were conducted across the United States in areas where project activities would be applicable (i.e. their implementation would be additional) . The results of the stakeholder consultation lead directly to substantial changes to the grower contract. Since then, the need for substantial changes to the grower contract has not been necessary, but smaller changes to the grower contract still take place as needed based on grower feedback. Feedback is most often given at time of signing their initial fields up to be apart of the grouped project and during the addition of new fields, but we encourage feedback on contract conditions on a rolling basis. These highly commercially sensitive contracts have been given to the VVB for their review, to highlight the changes that have occurred since the inception of the project.
Consultation outcome	Before joining the Program, farmers must sign a contract between themselves and Agoro Carbon that ensures they understand all possible outcomes of project implementation. During consultation of each potential stakeholder, common questions that arose surrounded Agoro Carbon’s end goal with carbon credits generated, project implementation schedule, and scheduling soil sampling appointments. During these conversations, our Grower Success Team and Sales Team, besides answering the aforementioned queries, addressed the requirement of continuing to adhere to relevant laws and regulations covering practice implementation and labor rights. During consultation events and smaller, private consultation events, testimonies and examples from our other project participants were highlighted to demonstrate potential risks, costs and benefits of project implementation.
Ongoing communication	Agoro Carbon Grower Success Team members conduct annual check-ins through email, phone, and in person site visits.
Stakeholder input	Input from the farmers and others in the US agricultural space informed every aspect of project design. Agoro Carbon has carefully catered the contracts with consultation from farmers to ensure the project activities, terms, and incentives fit the specific needs of participating farmers. Input received during consultation events have informed how we communicate with new and existing project participants.

2.1.3 Free Prior and Informed Consent

Obtaining consent	Agoro Carbon does not implement the project activities directly, instead relies on participating farmers. All farmers have to sign the "Carbon Credit Generation Agreement" and therefore all activities implemented on the land are agreed to through the agreement that has been freely negotiated between the parties, even involving consultation with legal counsel. Farmers enrolled in our program that are living within the boundaries of a Federal Indian Reservation must demonstrate that they have consent from relevant tribal authorities to carry out project activities and receive payment from the Agoro Carbon Alliance for doing so. Project activities are not limited to project interventions, they include scheduled soil sampling, and check-ins from our Grower Success Team.
Outcome of FPIC	As stated above, Agoro Carbon only works with (enters into agreements with) farmers who can demonstrate rights to the land, either by ownership or lease agreements over the farms. Farmers are required to produce information pertaining to these rights, which includes the length of the agreement. This is done in writing by means of an attestation letter that forms an integral part of the Carbon Credit generation Agreement. Therefore, the free prior and informed consent was obtained from all participating farmers. Farmers enrolled in our program that are living within the boundaries of a Federal Indian Reservation have demonstrated that they have permission from relevant tribal authorities to carry out project activities and receive payment from Agoro Carbon for doing so. Agoro Carbon will not enter into an agreement with a farmer if they cannot produce evidence from local relevant tribal authorities that they have explicit consent to operate on tribal lands, implementing practice changes and subsequently receiving finance for doing so.

2.1.4 Grievance Redress Procedure

Use the table below to describe the grievance redress procedures developed to resolve any conflicts which may arise between the project proponent and stakeholders.

Development process	All of our sales and grower success team members have backgrounds in agriculture. They are all familiar with the culture

	and business of the areas they serve. Our procedures for ongoing communication with our growers have been crafted by our experienced staff with input from our farmers and ranchers alike.
Grievance redress procedure	At the onset of participation in the Agoro Carbon Program, all project participants meet members of the sales and Grower Success Team. Contact information is exchanged, and an open line of communication is established. In the event of grievance or general feedback, farmers are encouraged to either call, write, text, or email Agoro Carbon staff members to communicate via the aforementioned mediums or to set up an in-person meeting. Farmers may also elect to air grievances and feedback to Channel Partners who will then pass the message along to Agoro Carbon staff. Agoro Carbon additionally hosts "Grower Appreciation Events" where farmers not only can speak with members of the Grower Success and Sales Team, but other members of Agoro Carbon to speak to other attributes surrounding the Project. If the grievance is not resolved through communication with the Grower Success Team or a Channel Partner the farmer may request the grievance be elevated to the Agoro Carbon team directly. The Agoro Carbon team will then act as an independent mediator, or contact the local USDA Agricultural Extension Agent to act as an independent mediator if the Agoro Carbon team does not believe they may maintain independence. The Carbon team can be reached by contacting individual members, or at carbonteam@agorocarbon.com.

2.1.5 Public Comments

This project was open for public comment from 11th May 2023 to 10th June 2023

Comments received	Actions taken
No comments were received during or after the public comment period.	N/A

2.2 Risks to Stakeholders and the Environment

2.2.1 Risk Assessment

	Risks identified	Mitigation or preventative measure(s) taken
Risks to stakeholder participation	Implementation of new practices can possibly lead to changes in yields. The expected outcome is positive as implementation of new practices should lead to increased yields. There is always a risk when deviating from baseline practices of lower yields.	Payments that are made upon signing in effect cover this risk. If at any point in time the Project is not working for a farmer, they may exit the Project.
Working conditions	No risk identified	Working conditions remain the same from the baseline scenario to the project scenario.
Safety of women and girls	No risk identified	Project activities do not impede on the safety of women and girls. Safety measures taken in the baseline scenario are continuously adhered to in the project scenario. Implementation of project activities does not lead to the heightened risk of any occupational danger.
Safety of minority and marginalized groups, including children	No risk identified	Project activities do not impede on the safety of minority and marginalized groups, including children. Safety measures taken in the baseline scenario are continuously adhered to in the project scenario. Implementation of project activities does not lead to the heightened risk of any occupational danger.
Pollutants (air, noise, discharges to water, generation of waste, and release of hazardous materials and chemical pesticides and fertilizers)	No risk identified	Project implementation does not lead to the proliferation of pollutants from the baseline scenario, nor the introduction of any new pollutants.

Local stakeholder resources	Implementation of new practices can possibly lead to changes in yields. The expected outcome is positive as implementation of new practices should lead to increased yields. There is always a risk when deviating from baseline practices of lower yields. There are no other potential negative impacts to local resources as the project activities are intended to improve the local resources.	Payments that are made upon signing in effect cover this risk. If at any point in time the Project is not working for a farmer, they may exit the Project.

2.3 Respect for Human Rights and Equity

2.3.1 Labor and Work

Discrimination and sexual harassment	Agoro Carbon is dedicated to being an equal opportunity employer as defined by the International Labor Organization (ILO). The ILO Convention defines discrimination as "any distinction, exclusion, or preference made on the basis of race, color, sex, religion, political opinion, national extraction, or social origin, which has the effect of nullifying or impairing equality of opportunity or treatment in employment or occupation." All farmers and those contracted with Agoro Carbon must adhere to all state and federal laws pertaining to labor practices.
Management Experience	Agoro Carbon staff have worked, lived, and established themselves in the same communities that project participants and local stakeholders inhabit. Agoro Carbon staff have experience implementing practice changes as prescribed in VM0042 v2.0 and have engaged extensively either in the field or academically with these practices and communities.
Gender equity in labor and work	Agoro Carbon is dedicated to being an equal opportunity employer as defined by the International Labor Organization (ILO). The ILO Convention defines discrimination as "any distinction, exclusion, or preference made on the basis of race, color, sex, religion, political opinion, national extraction, or social origin, which has the effect of nullifying or impairing equality of opportunity or treatment in employment or occupation." All farmers and those contracted with Agoro Carbon must adhere to all state and federal laws pertaining to labor practices.

Human trafficking, forced labor, and child labor	All farmers and those contracted with Agoro Carbon must adhere to all state and federal laws pertaining to labor practices. Our business partners and project participants are subject to a certain mandatory code of conduct; this is the clause included in the contract that they sign with Agoro Carbon before being involved in our project.

2.3.2 Human Rights

Internally, Agoro Carbon is dedicated to being an equal opportunity employer as defined by the ILO. The ILO Convention defines discrimination as “any distinction, exclusion, or preference made on the basis of race, color, sex, religion, political opinion, national extraction, or social origin, which has the effect of nullifying or impairing equality of opportunity or treatment in employment or occupation.” The ILO requires ratifying states to declare and pursue a national policy designed to promote, by methods appropriate to national conditions and practice, equality of opportunity and treatment in respect of employment and occupation, with a view to eliminating any discrimination in these fields. This includes discrimination in relation to access to vocational training, access to employment and to particular occupations, and terms and conditions of employment. The United States is a ratifying state of this convention. The standards set by international organizations like the ILO, all farmers and those contracted with Agoro Carbon must adhere to all state and federal laws pertaining to labor practices.

Agoro Carbon acknowledges and honors the principles of the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) and the ILO Convention 169 on Indigenous and Tribal Peoples by ensuring that the farmers enrolled in our Program have received explicit, documented permission from local relevant tribal authorities to cultivate their lands, thereby respecting and upholding the sovereignty, traditional lands, and cultural rights of Native American communities. Through our commitment to the proliferation of sustainable agricultural practices, we actively contribute to the protection and promotion of the environmental stewardship and cultural heritage intrinsic to Indigenous peoples, as championed by UNDRIP and ILO Convention 169.

2.3.3 Indigenous Peoples and Cultural Heritage

Promoting regenerative agricultural practices helps preserve and protect Native American cultural heritage by maintaining the health of the land that is deeply connected to indigenous traditions and ways of life. These practices support soil health and biodiversity, which are central to the sustainable use of natural resources, a principle that resonates with the stewardship values held by many Native American cultures. Our promotion of regenerative agricultural practices happens on Native American reservations in more ways than one. Besides the financial incentive provided to farmers and the soil sampling conducted, there is a great deal of education and capacity building that occurs. Our Grower Success Team works with our farmers to ensure proper project implementation and proper land management is conducted.

Native American history is unfortunately fraught with mistreatment and mismanagement of their land and resources by the hands of others. Agoro Carbon understands and recognizes this, and takes every available avenue to ensure that adequate permission from relevant tribal authorities have been obtained by those wishing to enroll in our program.

2.3.4 Property Rights

Rights to territories and resources	Agoro Carbon only works with farmers who already have the rights to farm on the land. A mandatory attestation letter is required in the "Carbon Credit Generation Agreement", whereby farmers declare the uncontested property interest and title to the land (ownership, lease, or other commercial arrangement) and their ability to implement the practices in those fields. Farmers further covenant and declare that such rights shall remain in place during the term of the agreement. Farmers enrolled in our program that are living within the boundaries of a Federal Indian Reservation must demonstrate that they have consent from relevant tribal authorities to carry out project activities and receive payment from Agoro Carbon for doing so. Project activities are not limited to project interventions, they include scheduled soil sampling, and check-ins from our Grower Success Team.
Respect for property rights	As stated above, Agoro Carbon only works with farmers with existing land rights, thereby recognizing those rights.

2.3.5 Benefit Sharing

Section not applicable as this project does not impact property rights as described in Section 2.3.4 above.

2.4 Ecosystem Health

	Risks identified.	**Mitigation or preventative measure taken**
Impacts on biodiversity and ecosystems	Possible proliferation of introduced species via cover crop implementation.	Growers terminate cover crops before they get a chance to seed. Growers also take measures to actively monitor and manage cover crops throughout their lifecycle, ensuring they do not spread outside of the project area.
Soil degradation	No risk identified.	Practice implementation has been shown to reduce soil degradation and soil erosion.

and soil erosion		
Water consumption and stress	No risk identified.	Practice implementation has been shown to conserve water by increasing soil structure and reducing soil erosion.
Usage of fertilizers	No risk identified.	Fertilizer usage is reduced in the project scenario through active nitrogen management, and the use of nitrogen fixing species in cover cropping.

2.4.1 Rare, Threatened, and Endangered Species

Is the project located in or adjacent to habitats for rare, threatened, or endangered species?

☒ Yes ☐ No

Species and habitat	
The program's geographic area is delineated by political borders of the USA (excluding Alaska and Hawaii) and includes only cropland. The list of endangered species found in the United States can be found by consulting the latest version of the Endangered Species Act of 1973.	Project participants must follow all local and federal laws pertaining to adherence to the Endangered Species Act of 1973. Project interventions, like implementing cover cropping and no-tillage, have been shown to prevent soil erosion and reduce runoff of pollutants downstream into other riparian and wetland areas.
Areas needed for habitat connectivity	Habitat connectivity requires preserving and enhancing corridors such as hedgerows, riparian buffers, field margins, and adjacent natural areas. These features support wildlife movement, pollinators, and biodiversity across agricultural landscapes. Regenerative farming practices like cover cropping and reduced tillage do not disrupt habitat connectivity and often improve it by enhancing soil health, increasing plant diversity, and providing year long cover and food sources for wildlife.

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2.4.2 Introduction of Species

Species introduced	Classification	Justification for use	Adverse effects and mitigation
Annual Rye			

Clover Wheat Sun Hemp Brassica Sorghum-Sudan Grass Hairy Vetch Lablab Triticale Oats Millet Buckwheat Common Vetch Perennial Ryegrass Barley Pea Hazlet Cereal Rye Corn	Non-native species, sometimes planted as a monoculture but more often planted in tandem in a seed mix	Used as a cover crop in the project scenario	Can spread if not managed correctly and compete with native species outside agricultural areas. This is mitigated by terminating the cover crop before it goes to seed, ensuring there is no proliferation.

Existing invasive species	Mitigation measures to prevent spread or continued existence of invasive species
The Program's geographic area is delineated by political borders of the USA (excluding Alaska and Hawaii) and includes only cropland. The list of invasive species found in the United States can be found through the USDA's National Invasive Species Information Center.	Mitigation activities to prevent the spread of invasive species predates the project start date. Conventional mitigation activities prescribed by local institutions and Government agencies, like the USDA, include mechanical, biological, and chemical means of control.

2.4.3 Ecosystem Conversion

Preserving natural ecosystems alongside farmland is crucial as it fosters biodiversity, enhances soil health, and promotes natural pest control, contributing to sustainable and resilient farming practices.

According to VCS Program Definitions v4.4 a native ecosystem is “A landscape composed of naturally occurring and self-sustaining biotic and abiotic components demonstrated by peer-reviewed literature, expert judgment, or government registry”.

Agoro Carbon utilizes USDA definitions and boundaries for its determination of land cover prior to project implementation. Specifically, the USDA’s National Agricultural Statistics Service (NASS) Cropland Data Layer (CDL) , which is an annual raster, geo-referenced, crop-specific land cover data layer produced using satellite imagery and extensive agricultural ground reference data. The program began in 1997 with limited coverage and in 2008 forward expanded coverage to the entire Continental United States. This is done in tandem with our team’s “Change Detection” method of ensuring conformance. This is the process our team takes when analyzing changes that have occurred in the land surface or features over time using satellite or aerial imagery. By combining the use of multiple data layers, as well as the manual change detection method used by the team, we are able to confidently ensure conformance.

Besides due diligence that occurs internally, we also take a contractual approach to this as well. Prior to signing a contract with Agoro Carbon, growers are interviewed by Agoro Carbon representatives to confirm that the land they are enrolling has not been cleared of native ecosystems at least 10 years prior to their inclusion in the project. After this interview is conducted, and a grower wants to join the project, they legally confirm in a contract that their acres enrolled into the project have not been cleared of native ecosystems within the 10-year period immediately prior to the project start date.

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

Type (methodology, tool or module).	Reference ID, if applicable	Title	Version
Methodology	VM0042	Methodology for Improved Agricultural Land Management	2.0
Module	VMD0053	Model Calibration, Validation, and Uncertainty Guidance for the Methodology for Improved Agricultural Land Management	2.0

3.2 Applicability of Methodology

Methodology ID	Applicability condition	Justification of compliance
VM0042	Projects must introduce or implement one or more new changes to pre-existing agricultural management practices which: a. Improve fertilizer (organic or inorganic) management; b. Improve water management/irrigation; c. Reduce tillage/improve residue management; d. Improve crop planting and harvesting (e.g., improved agroforestry, crop rotations, cover crops); and/or e. Improve grazing practices.	The project regenerative practices, as described in Section 1.11, are listed as eligible practices under VM0042 methodology. The project will assure that the different types of project practices will be implemented on the field. This is prescribed by the contract the farmers are signing with the program and will be controlled by the usage of remote sensing data, direct monitoring and where feasible by conducting the interviews with the farmers.
VM0042	Projects that introduce or implement quantitative adjustments (e.g., decrease in fertilizer application rate) must exceed five percent of the pre-existing value, calculated as the average value over the historical look-back period, developed for the baseline schedule of activities	We monitor the necessary quantitative adjustments as relevant to practice(s) implementation, and calculate in such cases the percent of the pre-existing value, based on the monitored data during project implementation and the average value over the historical look-back period, developed for the baseline schedule of activities, to assure that five percent threshold is met.

		Each new instance's baseline will be assessed through data collected on a field level going back 5 years constituting the historical look back period. All existing instances have average values associated with each of their quantitative adjustments (e.g. number of tillage passes per field, pounds per acre of N applied, etc.) take stock of so that adjustments are made to exceed five percent of the pre-existing value, calculated as the average value over the historical look-back period, developed for the baseline schedule of activities
VM0042	Project activities must be implemented on land that is either cropland or grassland at the project start date	Only cropland is included in the project activity. This is regulated by the contract with the farmers enrolled in the program and is also checked by the team examining each field before inclusion of the cropland into the project using google earth imagery, onX mapping software and other data
VM0042	Empirical or process-based models used to estimate stock change/emissions via Quantification Approach 1 must be: • Publicly available, though not necessarily free of charge, from a reputable and recognized source (e.g., the model developer's website, IPCC or government agency). Sufficient conceptual documentation of inputs, outputs and information on how the model functionally represents SOC dynamics must be accessible to the public. Providing the source code or an API for independent replication of calculations is not required; • Shown in peer-reviewed scientific studies to successfully simulate changes in SOC and trace gas emissions resulting from the changes in ALM practices included in the project description;	The appropriate use of the DAYCENT model is validated by the Independent Modelling Expert in the report titled "Review Revised MCVR Agoro Carbon USA Cropland Program"

	• Able to support repetition of the project model simulations. This includes clear versioning of the model used in the project and stable software support, as well as fully reported sources and values for all parameters used with the project version of the model. Where multiple sets of parameter values are used in the project, clearly identify the sources of varying parameter sets and how they were applied to estimate stock change/emissions in the project. Acceptable sources include peer-reviewed literature and statements from appropriate expert groups that demonstrate evidence of expertise with the model via authorship of peer reviewed model publications or authorship of reports for entities supporting climate-smart agriculture. These sources must describe the datasets and statistical processes used to set parameter values; • Validated per datasets and procedures detailed in Section 5.2 of VMD0053 Model Calibration and Validation Guidance for the Methodology for Improved Agricultural Land Management. Model prediction error must be calculated using datasets as described in Section 5.2.5 of VMD0053 and must use the same parameters or sets of parameters applied to estimate stock change/emissions in the project; and • Using the same model version in the baseline and project scenarios. Further, the same parameters/ parameter sets must be used in the baseline and project scenarios. Model input data must be derived following guidance in Table 6 and Table 8. Model uncertainty must be quantified following guidance in Section 8.6. Models may be recalibrated or revised based on new data, or a new model may be	

	applied, provided the above requirements are met.	
VM0042	The project area must not have been cleared of native ecosystems within the 10 year period prior to the project start date.	A full explanation of how Agoro Carbon vets project areas can be found in section 2.4.3 of this Project Description.
VM0042	The project activity is not expected to result in a sustained reduction of greater than 5% in productivity, as demonstrated by peer reviewed and/or published studies on the activity in the region or a comparable region.	Market leakage is likely to be negligible because the land in the project scenario remains in agricultural production. Further, farmers are unlikely to implement and maintain management practices that result in productivity declines, since their livelihoods depend on crop harvests as a source of income. Nevertheless, to ensure leakage is not occurring, the following will be completed every 10 years: Average with-project productivity (excluding years with extreme weather events) of each crop/livestock product will be compared to average pre-project productivity of the same crop/livestock product OR the ratio of average baseline productivity to regional productivity at time t will be compared to the average ratio of project productivity to regional productivity at time t + 10 years, by crop/livestock product, using regional data from government (e.g., USDA Actual Production History (APH) data), industry, published, academic or international organization (e.g., FAO) sources.
VM0042	The project activity is not a biochar application. Biochar may be applied as a soil amendment in the project area provided that the total organic carbon content of the biochar applied is subtracted from the estimated SOC stock change in the project scenario at each verification event.	N/A. Biochar application is not part of the project activity.
VM0042	The project activity cannot occur on a wetland.	Growers are interviewed prior to their inclusion into the project to confirm that their acres are not

		on wetlands. The contract for their inclusion into the program also stipulates that acres they are enrolling into the program are not on wetlands. Finally, we overlay their acres on USFWS's National Wetland Inventory to ensure none of the enrolled acres overlap with wetlands.

3.3 Project Boundary

The geographic boundaries of the PAIs have been established based on the geopolitical boundaries of the following US states: Colorado, Idaho, Illinois, Indiana, Minnesota, Nebraska, Oregon, South Dakota, Texas, Washington, and Wisconsin. Future PAIs may be added from any location within the identified geographic boundaries (states), provided they meet the eligibility requirements outlined in Section 1.4 and section 1.5.1. This also includes that the baseline scenario for the land unit aligns with the "business-as-usual" practices defined in Section 3.4 of the PD, and that the additionality criteria applied in Section 3.5 are met, regardless of the state. If new instances are identified that lie outside one of the identified states, a new geographic boundary must be created and validated to ensure it meets the baseline and additionality requirements of the project and methodology.

All GHG sources and pools are accounted for in the project boundary. The rationale behind their exclusion or inclusion comes from VM0042 v2.0 and is annotated in the tables below. All carbon pools besides Soil Organic Carbon are omitted due to the fact that VM0042 v2.0 lists them as optional or not included.

Source		Gas	Included?	Justification/Explanation
Baseline	Soil Organic Carbon	CO_2	Included	Soil organic carbon is measured on the onset of the project to account for the baseline and periodically measured throughout the project lifetime every 5 years.

Source		Gas	Included?	Justification/Explanation
	Fossil fuel	CO_2	Excluded	We will determine the fuel used on farm for four activity types: tillage, planting, spraying for weed/pest/termination, and fertilizer application per crop. These activities represent the events in which heavy machinery that relies on fossil fuel will be used. Harvesting has been excluded from this list as there is no change in harvesting operations due to the implementation of project activities, and therefore, no change in baseline vs project emissions. Estimates of gallons of fuel consumed per acre per activity will be sourced from the Field Operations chapter of the Illinois Farm Management Handbook, published by the University of Illinois. For each instance, each fossil fuel activity will be categorized per the operation type in the Field Operation chapter and then multiplied by the area of the field to determine total fuel consumption. This approach will be conducted for both the baseline and project scenarios per crop to determine the change in emissions from the baseline to project scenario.
	Soil methanogenesis	CH_4	Excluded	Excluded. Project activities will not result in a significant increase

Source		Gas	Included?	Justification/Explanation
				in soil methanogenesis. This has been found to be de minimis. Supporting evidence has been given to the validator.
	Enteric Fermentation	CH_4	Included	Enteric fermentation will be managed and monitored in the baseline scenario.
	Manure Deposition	CH_4	Included	Manure deposition will be managed and monitored in the baseline scenario.
		N_2O	Included	Manure deposition will be managed and monitored in the baseline scenario.
	Use of Nitrogen Fertilizers	N_2O	Included	The use of nitrogen-based fertilizers will be managed and monitored in the baseline scenario.
	Use of Nitrogen Fixing Species	N_2O	Included	In case the use of nitrogen fixing species is present in the baseline scenario, it will be managed and monitored in the baseline scenario.
	Burning biomass	CO_2	Excluded	Excluded. Project activities will not result in a significant increase in CO_2. This has been found to be a de minimis source. Supporting evidence has been given to the validator.
		CH_4	Excluded	Excluded. Project activities will not result in a significant increase in CH_4. This has been found to be a de minimis source. Supporting evidence has been given to the validator.

Source		Gas	Included?	Justification/Explanation
		N_2O	Excluded	Excluded. Project activities will not result in a significant increase in N_2O. This has been found to be a de minimis source. Supporting evidence has been given to the validator.
	Woody biomass	CO_2	Excluded	Excluded. Project activities will not result in a significant increase in CO_2. This has been found to be a de minimis source. Supporting evidence has been given to the validator.
Project	Soil Organic Carbon	CO_2	Included	Soil organic carbon is measured on the onset of the project to account for the baseline and periodically measured throughout the project lifetime every 5 years.
	Fossil fuel	CO_2	Excluded	Excluded. Project activities will not result in a significant increase in the use of fossil fuels. Fossil fuel usage has been found to be de minimis. Supporting evidence has been given t.
	Soil methanogenesis	CH_4	Excluded	Excluded. Project activities will not result in a significant increase in soil methanogenesis. This has been found to be de minimis. Supporting evidence has been given to the validator.
	Enteric Fermentation	CH_4	Included	Enteric fermentation will be managed and monitored in the project scenario.

Source		Gas	Included?	Justification/Explanation
	Manure Deposition	CH_4	Included	Manure deposition will be managed and monitored in the project scenario.
		N_2O	Included	Manure deposition will be managed and monitored in the project scenario.
	Use of Nitrogen Fertilizers	N_2O	Included	The use of nitrogen-based fertilizers will be managed and monitored in the project scenario.
	Use of Nitrogen Fixing Species	N_2O	Included	In case the use of nitrogen fixing species is present in the project scenario, it will be managed and monitored in the project scenario.
	Burning biomass	CO_2	Excluded	Excluded. Project activities will not result in a significant increase in CO_2. This has been found to be a de minimis source. Supporting evidence has been given to the validator.
		CH_4	Excluded	Excluded. Project activities will not result in a significant increase in CH_4. This has been found to be a de minimis source. Supporting evidence has been given to the validator.
		N_2O	Excluded	Excluded. Project activities will not result in a significant increase in N_2O. This has been found to be a de minimis source. Supporting evidence has been given to the validator.
	Woody biomass	CO_2	Excluded	Excluded. Project activities will not result

Source		Gas	Included?	Justification/Explanation
				in a significant increase in CO_2. This has been found to be a de minimis source. Supporting evidence has been given to the validator.

3.4 Baseline Scenario

The continuation of pre-project cropland management practices by each farmer, on each field in each of the geographic areas, as before the Project, is the most plausible baseline scenario for row crop production in the continental United States. Historical management practices, including history of crop planted, agricultural practices, management, and yield at the field level are determined via a 3-year or a full crop rotation lookback period. The evidence that makes up our 3 year look back period consists of management plans, field boundaries, machine data, receipts, and/or other supporting documentation. Data collection followed the guidance of Box 1 of the methodology, prioritizing grower historical data and attestations of past actions. The practices carried out in the 3 years preceding the program are in line with the most common practices in their respective regions. This can be attested to by USDA and state level data. This is evidence that the historic lookback data is an accurate representation of the management choices. This management data is paired with a baseline soil sample that allows the model to predict the impact on SOC for each instance in both the baseline and project scenario.

Table 4 of the VM0042 Methodology, minimum specifications for ALM practices, was used as a guide to review historic look back data from growers to create a schedule of activities, which can be found in Appendix 2: Historical Data. The schedule of activities shows that while there are always variations in practice implementation in each state, the practices that Agoro Carbon is incentivizing in each state are not part of the baseline scenario. The baseline scenario for each state captures the regional differences in practice implementation, and all states share one baseline scenario characteristic, which is the lack of implementation of cover cropping, reduced/no till, and nitrogen management.

The schedule of activities is used for modelling changes of SOC stocks following VM0042 Approach 1. The schedule of activities modeled per instance will be re-evaluated throughout the crediting period to reflect current agricultural production in the region. Published regional agricultural production data from within the 10-year period preceding the end of the current baseline period has been consulted.

The rationale and sources for supplying quantitative and qualitative data is derived from VM0042's Box 1. Qualitative and quantitative data pertaining to management practices has been sustained by signed attestations from farmers.

3.5 Additionality

3.5.1 Regulatory Surplus

Is the project located in an UNFCCC Annex 1 or Non-Annex 1 country?

☒ Annex 1 country ☐ Non-Annex 1 country

Are the project activities mandated by any law, statute, or other regulatory framework?

☐ Yes ☒ No

3.5.2 Additionality Methods

The additionality of the project is performed following the project method as specified in the applied methodology. In order for the project to be considered additional, in addition to the demonstration of regulatory surplus, the following shall be conducted:

- Identify barriers that would prevent the implementation of a change in pre-existing agricultural management practices.
- Demonstrate that the adoption of the suite of proposed project activities is not common practice

The additionality of the project is demonstrated below.

1. Barrier Analysis

There are numerous barriers for farmers to implement project practices in the USA. While the project areas are contained within specific geographic areas (states), due to sociocultural and economic homogeneity across the continental United States, the barriers farmers face in the United States when transitioning to regenerative practices are universal. These are described in the sections below in more detail.

Barrier 1. Investment / Financial barrier

Economic barriers were named as most common barrier for regenerative agricultural practices implementation in USA. The lack of facilitating infrastructure to support adoption of conservation practices is an important structural barrier for the farmers. The capital investments and education supported are required to update farm equipment and management skills to adopt conservation practices.

According to Xie 2014 as cited Ranjan et al 2019, high implementation costs emerged as a barrier to adoption of changing to no-till from conventional tillage farming, nutrient management in the USA. Costs associated with establishment and termination of cover crops were also identified as barriers to adoption of cover crop practice (Krajewski 2017; Reimer, Weinkauf, and Prokopy 2012; Roesch-McNally et al. 2017 as cited Ranjan et al 2019).

The process of applying for government conservation programs, such as Conservation Stewardship Program (SCP) through Natural Resource Conservation Service (NRCS), and their associated requirements was predominantly discussedas a barrier to conservation program adoption. Concerns with excessive paperwork, lengthy application processes, and program complexity and requirements were discussed as hindering enrollment.

Lastly, some conservation practices do not result in an immediate improvement to farm profitability or productivity but are instead long-term investments in a farm's system. Thus, switching practices may require upfront investments made solely to improve the system that might not yield tangible economic gains, at least early on. For example, unlike commodity crops, winter cover crops do not necessarily produce marketable products that could be sold to help recoup costs of planting and maintenance. This can make it challenging for a grower to offset the costs of winter cover planting and termination and thus reduces motivation to plant winter cover without any perceived upside, such as improvements to productivity or resilience.

The development of this carbon Program and generation of carbon revenues will allow Agoro Carbon to provide project participants (farmers) upfront and continuing funding support for the investment in the needed infrastructure and educational/training resources needed for them to overcome the cost constraint barriers to implement the project activity.

Barrier 2: Risks of yield shortage

Farmers often are also concerned about reduced yield as result of regenerative agriculture practices implementation, which influence the adoption of cover crops (Roesch-McNally et al. 2017), conservation tillage (Reimer, Weinkauf, and Prokopy 2012), reduced nitrogen application (Stuart, Schewe, and McDermott 2014) as cited by Ranjan et al 2019. The key findings of the study conducted by Tolivere et al 2014 support the hypothesis that soil and climate factors impact no-till yields relative to tillage yields and may be an important factor influencing risk and expected return and the adoption of the practice by farmers. Pittelkow et al. 2015 suggests that improved targeting and adaptation, possibly including additional system modifications, are necessary to optimize no-till performance and contribute to food production goals.

In this Program, Agoro Carbon will provide continuous agronomic support tailored to each of the farmers enrolled into the Program on the correct and most efficient implementation approach for the implementation of practices in order to reduce risks of yield shortage. The Program also will provide carbon finance as price premium in order to mitigate farmers risk related to any disturbances in farms operation and will help to compensate any possible yield shortages on the short-term, thus helping to overcome this barrier as well.

Barrier 3: Lack of knowledge and skills in project implementation

Farmers run complex operations on their land. Unpredictability from nature and the market leaves little room for experimentation or divergence. A farmer runs their business based on their expertise working with the land and collective knowledge and experience.

Introducing new agricultural practices increases the complexity in farm management. Changing a practice requires significant time and resources, and typically significant risk is assumed by the farmer in changing their operations. Most studies identify compatibility of conservation practices with farm management and additional management efforts as a barrier for practice implementation in the USA (Ranjan et al 2019).

Educational barriers, such as lack of knowledge on how to implement the practices, were a widely cited barrier to adoption of regenerative agricultural practices. To bring regenerative agriculture practices into use, the farmers need region-specific knowledge from trusted sources and have confidence that they have sufficient knowledge or guidance to implement regenerative agricultural practices and how this implementation will impact their short-term and long-term production. Often farmers have a lack of knowledge on conservation agriculture due to longstanding relationships with agricultural consultants who are trained in traditional ways of farming. They operate mostly in a traditional way and lack trusted technical, financial, institutional, and peer support to aid in implementing regenerative agricultural practices.

For example, in the USA the cover crop termination and residue incorporation, due to their demand on farmers' time and wet conditions during spring, were perceived to be inconvenient and risky for farmers (Christianson et al. 2014 cited Ranjan et al 2019). Buck 2022 suggested that this could be remedied by more technical assistance. In order to close this educational gap Agoro Carbon will provide continuous agronomic support specific to each of the farmers enrolled into the Program on the correct and most efficient implementation approach for the implementation of project practices. These activities will enable to remove this barrier for the farmers enrolled into Agoro Carbon Program.

Barrier 4: Social barrier

There are also social barriers that play an important role in reducing adoption rates of conservation practices. To survive and thrive over generations, farmers depend on their communities for mutual support and shared knowledge. Therefore, social norms and level of local community adoption are important factors in practices implementation.

Transitioning to regenerative agriculture involves the putting down of traditional agricultural methods and practices that have been relied on and trusted by farmers for years. Grower perceptions of practices, such as beliefs that conservation practices present a risk to cash crop yields and beliefs around low overall profitability and high labor demand, reduce the likelihood that farmers will make a practice change.

Carolan 2006 has found that farmers were in most cases hesitant to try practices that have not been adopted by the surrounding agricultural and grower-peer community. Also blame shifting was mentioned by Ranjan et al 2019 as hindering adoption. (Ranjan et al 2019).

Agoro Carbon Program is aimed to increase the adoption rate of agricultural practices in the farmers community, thus helping overcome this barrier in the long term. Also, Agoro Carbon education campaign on regenerative agriculture and capacity building activities with the farmers on the benefits of project practices for the soil health and also for the increase in yield on the longer term will lead to the shift the perception of the social norm and will contribute to elimination of this barrier.

<u>2. Common practice analysis</u>

The common practice analysis is conducted for each US state, in which initial instances (farmers) are enrolled, in line with the requirements of applied methodology on the analysis on 2nd level jurisdiction.

The most comprehensive data set for this exercise is the USDA's National Agricultural Statistics Service Census of Agriculture. This standardized census data is the most comprehensive for understanding practice implementation rates and it is conducted on a state by state level. National data (e.g. national penetration rate for no tillage) was far too broad and conversely, we found that county level data was more times than not lacking in certain counties or determined using different approaches in each state.

Using this data and guidance from VM0042 v2.0 Section 7, Step 3, Agoro Carbon has determined which activities are eligible in which state. Singular activities are eligible is the penetration rate is below 20%. In accordance with VM0042 , where growers are implementing multiple practices we determined the penetration rate by calculating the weighted average penetration rate of the two or more practices.

Agoro Carbon calculates the adoption rates per practice or practice combination at the farm level to ensure that there are no instances going above 20%. As per our calculations the penetration rates vary between 0.6% and 19% with a mean of 6% proving that all instances are additional.

Adoption rates for N management best management practices in the US are calculated based on literature sources and surveys, and for the no-till, reduced till and cover crop practices are calculated based on the SEP Additionality Tool v1.0 published by Climate Action reserve, taking also into account geographical distribution of the initial instances enrolled into the Program.

The detailed analysis on the adoption rates for each of the project practices and/or combination of the practices to be implemented for project instances included in the PD has been performed (detailed calculations are presented in the calculation file "Common practice assessment_PDD_Cropland USA_final draft.xlsx"). The result is presented in the table below. It is demonstrated that for initial project instances for each state the weighted adoption rate for practice mix is below the 20% benchmark as it is required by VM0042 v 2.0.

US State	Weighted Adoption Rate, in %
California	7.9%
Colorado	4.8%
Idaho	2.4%
Illinois	19.6%
Indiana	10.4%
Iowa	9.9%
Kansas	14%
Minnesota	0.6%
Missouri	0.3%
Nebraska	6.7%
North Dakota	0.1%
Oregon	6.7%
South Dakota	4.3%
Texas	4.2%
Washington	5.1%
Wisconsin	2.8%

As a result, it is proven that the project activity does not constitute a common practice. Based on the analysis presented above, all steps to prove the additionality are satisfied and the project activity is additional.

3.6 Methodology Deviations

There are no methodology deviations

4 QUANTIFICATION OF ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

Soil Organic Carbon

Soil organic carbon (SOC) will be quantified using Quantification Approach 1, Equation 6, as defined in VM0042 Section 8.2.1, using the DayCent model. DayCent is a process-based and publicly available model, which is commonly used to simulate changes in SOC and GHG fluxes over time. Accurate simulations are obtained at the field and soil strata-level using farm data, given different ecosystem and management scenarios.

In the baseline scenario, a farmers farming and overall practice history will be collected for at least one complete historical growing cycle and three historical years prior to their enrollment in this project. That cycle will be extrapolated back, due to the need for an equilibration period in DayCent simulations, and forward to current year + 10 with a second order markov chain. Equation (6):

$$SOC_{bsl,i,t} = f(SOC_{bsl,i,t})$$

Where:

$SOC_{bsl,i,t}$	= Estimated carbon stocks in the SOC pool in the baseline scenario for sample unit i at the end of year t (t CO2e/ha).
$f(SOC_{bsl,i,t})$	= Modeled SOC stocks in the baseline scenario for sample unit i in year t, calculated by modeling SOC stock changes over the course of the preceding year (t CO2e/ha).
i	= Sample unit.

Carbon Dioxide Emissions from Fossil Fuels

Project activities will not result in a significant increase in the use of fossil fuels. Fossil fuel usage has been found to be de minimis and therefore it is not included.. See section 3.3- Project Boundary for further details on the exclusion of emissions from fossil fuels in the project and baseline scenario.

Carbon Dioxide Emissions from Woody Biomass

Project activities will not result in increased woody biomass emissions. It has been found to be de minimis and therefore it is not included. Supporting evidence has been given to the validator.

Methane Emissions from the SOC Pool

Project activities will not result in an increase in methane emissions from the SOC pool. Soil methanogenesis has been found to be de minimis and therefore it is not included. Supporting evidence has been given to the validator.

Methane Emissions from Livestock Enteric Fermentation

Methane from livestock enteric fermentation in the baseline scenario will be calculated according to Equation 12, as outlined in VM0042 Section 8.2.6, using Quantification Approach 3. The respective equation is listed below:

Equation (12):

$$\underline{CH4\_ent_{bsl,i,t}} = \frac{\left(\frac{GWP_{CH4} \times \sum_{l=1}^{L} Pop_{bsl,l,i,t,P} \times EF_{ent,l,P}}{1000}\right)}{A_i}$$

Where:

$CH4\_ent_{bsl,i,t}$	= Annual mean methane emissions from livestock enteric fermentation in the baseline scenario for sample unit i in year t (t CO2e/ha).
$Pop_{bsl,l,i,t,P}$	= Population of grazing livestock of type l in sample unit i for productivity system P in year t in the baseline scenario (head numbers).
$EF_{ent,l,P}$	= Enteric fermentation emission factor for livestock type l in productivity system P (kg CH4/(head × year)).
l	= Type of livestock.
P	= Productivity system.
1000	= Conversion factor from kg to t.

Methane Emissions from Manure Deposition

Methane emissions from manure deposition in the baseline scenario will be calculated according to Equations 13 and 14, as outlined in VM0042 Section 8.2.7, using Quantification Approach 3. The respective equations are listed below:

Equation (13):

$$\underline{CH4\_md}_{bsl,i,t} = \frac{GWP_{CH4} \times \sum_{l=1}^{L} \left(Pop_{bsl,l,i,t,P} \times VS_{l,i,t,P} \times AWMS_{l,i,t,P,S} \times EF_{CH4,md,l,P,S} \right)}{10^6 \times A_i}$$

Where:

$\underline{CH4\_md}_{bsl,i,t}$ = Baseline areal mean CH4 emissions from manure deposition in the baseline scenario for sample unit i in year t (t CO2e/ha).

$VS_{l,i,t,P}$ = Average volatile solids excretion per head for livestock type l in sample unit i for productivity system P in year t (kg volatile solids/(head × day).

$AWMS_{l,i,t,P,S}$ = Fraction of total annual volatile solids for each livestock type l in sample unit i, that is managed in manure management system S in the project area, for productivity system P (dimensionless).

$EF_{CH4,md,l,P,S}$ = Emission factor for methane emissions from manure deposition for livestock type l for productivity system P in manure management system S (g CH4/(kg volatile solids)).

S = Manure management system.

10^6 = Conversion factor from grams to tonnes.

Equation (14):

$$VS_{l,i,t,P} = \left(VS_{rate,l,P} \times \frac{W_{bsl,l,i,t,P}}{1000} \right) \times 365$$

Where:

$VS_{rate,l,P}$ = Default volatile solids excretion rate for livestock type l for productivity system P (kg volatile solids/(1000 kg animal mass × day)).

$W_{bsl,l,i,t,P}$ = Average weight in the baseline scenario of livestock type l for sample unit i in productivity system P in year t (kg animal mass/head).

1000 = Conversion factor kg per tonne.

365 = Days per year.

<u>Methane Emissions from Biomass Burning</u>

Project activities will not result in a significant increase in biomass burning. Biomass burning has been found to be de minimis and therefore it is not included. Supporting evidence has been given to the validator.

<u>Nitrous Oxide Emissions from Nitrogen Fertilizers and Nitrogen-Fixing Species</u>

Nitrous oxide emissions from nitrogen fertilizer and nitrogen-fixing species in the baseline scenario will be calculated, according to Equations 17- 26, as outlined in VM0042 Section 8.2.9, using Quantification Approach 3.

The Equation 17 summarizes the calculation of emissions due to nitrogen inputs to soil, and it is indicated below:

Equation (17):

$$N2O\_soil_{bsl,i,t} = N2O\_fert_{bsl,i,t} + N2O\_md_{bsl,i,t} + N2O\_Nfix_{bsl,i,t}$$

Where:

$N2O\_soil_{bsl,i,t}$ = Nitrous oxide emissions due to nitrogen inputs to soils in the baseline scenario for sample unit i in year t (t CO_2e/ha).

$N2O\_fert_{bsl,i,t}$ = Nitrous oxide emissions due to fertilizer use in the baseline scenario for sample unit i in year t (t CO_2e/ha).

$N2O\_md_{bsl,i,t}$ = Nitrous oxide emissions due to manure deposition in the baseline scenario for sample unit i in year t (t CO_2e/ha).

$N2O\_Nfix_{bsl,i,t}$ = Nitrous oxide emissions from crop residues due to the use of N-fixing species in the baseline scenario for sample unit i in year t (t CO_2e/ha).

Equation 18 summarizes how emissions from fertilizer and manure application are quantified. The equation is listed below:

Equation (18):

$$N2O\_fert_{bsl,i,t} = N2O\_fert_{bsl,direct,i,t} + N2O\_fert_{bsl,indirect,i,t}$$

Where:

$N2O\_fert_{bsl,direct,i,t}$ = Direct nitrous oxide emissions due to fertilizer use in the baseline scenario for sample unit i in year t (t CO_2e/ha).

$N2O\_fert_{bsl,indirect,i,t}$ = Indirect nitrous oxide emissions due to fertilizer use in the baseline scenario for sample unit i in year t (t CO_2e/ha).

Equations 19-21 indicate how direct nitrous oxide emissions due to fertilizer use are quantified. The respective equations are listed below:

Equation (19):

$$\underline{N2O\_fert_{bsl,direct,i,t}} = \frac{\left(\left(FSN_{bsl,i,t} + FON_{bsl,i,t}\right) \times EF_{Ndirect} \times \frac{44}{28} \times GWP_{N2O}\right)}{A_i}$$

Equation (20):

$$FSN_{bsl,i,t} = \sum_{SF} M_{bsl,SF,i,t} \times NC_{SF}$$

Equation (21):

$$FON_{bsl,i,t} = \sum_{ON} M_{bsl,ON,i,t} \times NC_{ON}$$

Where:

$N2O\_fert_{bsl,direct,i,t}$	= Annual mean direct nitrous oxide emissions due to fertilizer use in the baseline scenario for sample unit i in year t (t CO_2e/ha).
$FSN_{bsl,i,t}$	= Synthetic N fertilizer applied to sample unit i in year t in the baseline scenario (t N)
$FON_{bsl,i,t}$	=Organic N fertilizer applied to sample unit i in year t in the baseline scenario (t N).
$EF_{Ndirect}$	= Emission factor for nitrous oxide emissions from N additions from synthetic fertilizers, organic amendments and crop residues (t N_2ON/t N applied).
$M_{bsl,SF,i,t}$	= Mass of N-containing synthetic fertilizer type SF applied to sample unit i in year t in the baseline scenario (t fertilizer).
NC_{SF}	= N content of synthetic fertilizer type SF (t N/t fertilizer).
$M_{bsl,ON,i,t}$	= Mass of N-containing organic fertilizer type OF applied to sample unit i in year t in the baseline scenario (t fertilizer).
NC_{ON}	= N content of organic fertilizer type OF (t N/t fertilizer).
SF	= Synthetic N fertilizer type.
OF	= Organic N fertilizer type.
$\frac{44}{28}$	= Molar mass ratio of N_2O to N applied to convert N_2O-N emissions to N_2O emissions.

Equations 22-24 indicate how indirect nitrous oxide emissions due to fertilizer use are quantified. The respective equations are listed below:

Equation (22):

$$\underline{N2O\_fert_{bsl,indirect,i,t}} = \frac{(N2O\_fert_{bsl,volat,i,t} + N2O\_fert_{bsl,leach,i,t})}{A_i}$$

Equation (23):

$$N2O\_fert_{bsl,volat,i,t} = [(FSN_{bsl,i,t} \times FRAC_{GASF}) + (FON_{bsl,i,t} \times FRAC_{GASM})] \times EF_{Nvolat} \times \frac{44}{28} \times GWP_{N2O}$$

Equation (24):

$$N2O\_fert_{bsl,leach,i,t} = (FSN_{bsl,i,t} + FON_{bsl,i,t}) \times FRAC_{leach} \times EF_{Nleach} \times \frac{44}{28} \times GWP_{N2O}$$

Where:

$\underline{N2O\_fert_{bsl,indirect,i,t}}$	= Annual mean indirect nitrous oxide emissions due to fertilizer use in the baseline scenario for sample unit i in year t (t CO_2e/ha).
$N2O\_fert_{bsl,volat,i,t}$	= Indirect nitrous oxide emissions produced from atmospheric deposition of N volatilized due to fertilizer use in the baseline scenario in sample unit i in year t (t CO_2e).
$N2O\_fert_{bsl,leach,i,t}$	= Indirect nitrous oxide emissions produced from leaching and runoff of N, in regions where leaching and runoff occurs, due to fertilizer use in the baseline scenario in sample unit i in year t (t CO_2e).
$FRAC_{GASF}$	= Fraction of all synthetic N added to soils that volatilizes as NH_3 and NOx (kg N volatilized/kg N applied).
$FRAC_{GASM}$	= Fraction of all organic N added to soils and N in manure and urine deposited on soils that volatilizes as NH_3 and NOx (kg N volatilized/kg N applied).
EF_{Nvolat}	= Emission factor for nitrous oxide emissions from atmospheric deposition of N on soils and water surfaces (t N_2O-N/(t NH_3-N + NOxN volatilized)).
$FRAC_{leach}$	= Fraction of N (synthetic or organic) added to soils and in manure and urine deposited on soils that is lost through leaching and runoff, in regions where leaching and runoff occurs, for manure management system S and livestock type l (kg N/kg N additions).
EF_{Nleach}	= Emission factor for nitrous oxide emissions from leaching and runoff (t N_2O-N/t N leached and runoff).

In case any nitrous oxide emissions due to the use of N-fixing species occur, they will be quantified following Equations 25 and 26. The respective equations are listed below:

Equation (25):

$$\underline{N2O\_Nfix}_{bsl,i,t} = \frac{\left(F_{CR,bsl,i,t} \times EF_{Ndirect} \times \frac{44}{28} \times GWP_{N2O}\right)}{A_i}$$

Where:

$\underline{N2O\_Nfix}_{bsl,i,t}$ = Annual mean nitrous oxide emissions from crop residues due to the use of N-fixing species in the baseline scenario for sample unit i in year t (t CO_2e/ha).

$F_{CR,bsl,i,t}$ = Amount of N in N-fixing species (above- and belowground) returned to soils in the baseline scenario for sample unit i in year t (t N).

Equation (26):

$$F_{CR,bsl,i,t} = \sum_{g=1}^{G} MB_{g,bsl,i,t} \times N_{content,g}$$

Where:

$MB_{g,bsl,i,t}$ = Annual dry matter (above- and belowground) of N-fixing species g returned to soils for sample unit i in year t (t dm).

$N_{content,g}$ = Fraction of N in dry matter for N-fixing species g (t N/t dm).

g = Type of N-fixing species.

Parameter	Value	Unit	Description	Source
Ai	13.86	ha	PAI size in hectares	Farm attestation
FSNbsl,i,t	3.20	t N	N inputs from synthetic fertiliser	EuropeAgriDB v1.0 (lan_lcv_ovw)
Mbsl,ON,i,t	0	t	Mass of organic fertiliser OF	Farm attestation
OF	None	-	Organic Fertiliser name	Farm attestation
NCON	-	-	N content of organic fertiliser OF	-
FONbsl,i,t	0	t N	N inputs from organic fertiliser	Equation 21 in VM0042 v 2.0
GWPN2O	265	t CO2e/t N2O	Global warming potential for N2O	Page 84 in VM0042 v 2.0
EFNdirect	0.01	t N2O-N/t N	Emission factor for nitrous oxide emissions from N additions from synthetic fertilisers, organic	Table 11.1 in 2019 IPCC Refinement*

			amendments and crop residues	
FRACGASF	0.11	-	Fraction of all synthetic N added to soils that volatilizes	Table 11.1 in 2019 IPCC Refinement*
FRACGASM	0.21	-	Fraction of all organic N added to soils that volatilizes	Table 11.3 in 2019 IPCC Refinement*
EFNvolat	0.01	t N2O-N/t N	Emission factor for N2O emissions from atmospheric deposition of N on soils and water surfaces	Table 11.3 in 2019 IPCC Refinement*
FRACleach	0.24	-	Fraction of N that is lost through leaching and runoff	Table 11.3 in 2019 IPCC Refinement*
EFNleach	0.011	t N2O-N/t N	Emission factor for N2O emissions from leaching and runoff	Table 11.3 in 2019 IPCC Refinement*
N2O_fertbsl,direct,i,t	0.96	t CO2e/ha	Areal mean direct N2O emissions due to fertiliser use	Equation 19 in VM0042 v 2.0
N2O_fertbsl,volat,i,t	1.46	t CO2e	Indirect N2O emissions produced from atmospheric deposition of N volatilized	Equation 23 in VM0042 v 2.0
N2O_fertbsl,leach,i,t	3.52	t CO2e	Indirect N2O emissions produced from leaching and runoff of N	Equation 24 in VM0042 v 2.0
N2O_fertbsl,indirect,i,t	0.36	t CO2e/ha	Areal mean indirect N2O emissions due to fertiliser use	Equation 22 in VM0042 v 2.0
N2O_fertbsl,i,t	1.32	t CO2e/ha	Areal mean N2O emissions due to fertiliser use	Equation 18 in VM0042 v 2.0
gwp	None	-	Name of N-fixing species	Farm attestation
MBg,bsl,i,t (MBag,bsl,i,t)	0	t dm	Annual dry matter above-ground residues returned to the soil	Equations 11.6 and 11.7 and Table 11.2 in 2019 IPCC Refinement*
MBg,bsl,i,t (MBdg,bsl,i,t)	0	t dm	Annual dry matter below-ground residues returned to the soil	Equations 11.6 and 11.7 and Table 11.2 in 2019 IPCC Refinement*
N2O_Nfixbsl,i,t	0	t CO2e/ha	Areal mean N2O emissions due to use of N-fixing species	No N-fixing species are applied in the baseline scenarios.

N2O_soilbsl,i,t	1.32	t CO2e/ha	Areal mean N2O emissions from soil	Equation 17 in VM0042 v 2.0

Nitrous Oxide Emissions from Manure Deposition

Nitrous oxide emissions from manure deposition in the baseline scenario will be calculated according to Equations 27-32, as outlined in VM0042 Section 8.2.10, using Quantification Approach 3. The respective equations are indicated below.

Equation (27):

$$\underline{N2O\_md_{bsl,i,t}} = N2O\_md_{bsl,direct,i,t} + N2O\_md_{bsl,indirect,i,t}$$

Where:

$\underline{N2O\_md_{bsl,i,t}}$ = Annual mean nitrous oxide emissions due to manure deposition in the baseline scenario for sample unit i in year t (t CO_2e/ha).

$N2O\_md_{bsl,direct,i,t}$ = Direct nitrous oxide emissions due to manure deposition in the baseline scenario for sample unit i in year t (t CO_2e/ha).

$N2O\_md_{bsl,indirect,i,t}$ = Indirect nitrous oxide emissions due to manure deposition in the baseline scenario for sample unit i in year t (t CO_2e/ha).

Equation (28):

$$\underline{N2O\_md_{bsl,direct,i,t,P}} = \frac{\sum_{l=1}^{L} F_{bsl,manure,l,i,t,P} \times EF_{N2O,md,l,S} \times \frac{44}{28} \times GWP_{N2O}}{A_i}$$

Equation (29):

$$F_{bsl,manure,l,i,t,P} = 1000 \times \left[\left(Pop_{bsl,l,i,t} \times Nex_{l,P} \right) \times AWMS_{l,i,t,P,S} \times MS_{bsl,l,t,t} \right]$$

Where:

$N2O\_md_{bsl,direct,i,t,P}$	= Annual mean direct nitrous oxide emissions due to manure deposition in the baseline scenario for sample unit i for productivity system P and manure management system S in year t (t CO_2e/ha).
$F_{bsl,manure,l,i,t,P}$	= Amount of nitrogen in manure and urine deposited on soils by livestock type l for productivity system P in sample unit i in year t (kg N).
$Nex_{l,P}$	= Average annual nitrogen excretion per head of livestock type l for productivity system P (kg N deposited/(head × year)).
$EF_{N2O,md,l,S}$	= Emission factor for nitrous oxide from manure and urine deposited on soils by livestock type l for manure management system S (kg N2O-N/kg N input).
$MS_{bsl,l,t,t}$	= Baseline fraction of total annual N excretion for each livestock type l for sample unit i in year t that is deposited on the project area (%).
1000	= Conversion factor from kg to t.

Equation (30):

$$\underline{N2O\_md_{bsl,indirect,i,t}} = \frac{(N2O\_md_{bsl,volat,i,t} + N2O\_md_{bsl,leach,i,t})}{A_i}$$

Equation (31):

$$N2O\_md_{bsl,volat,i,t} = F_{bsl,manure,l,i,t,P} \times FRAC_{GASM} \times EF_{Nvolat} \times \frac{44}{28} \times GWP_{N2O}$$

Equation (32):

$$N2O\_md_{bsl,leach,i,t} = F_{bsl,manure,l,i,t,P} \times FRAC_{LEACH} \times EF_{Nleach} \times \frac{44}{28} \times GWP_{N2O}$$

Where:

$\underline{N2O\_md_{bsl,indirect,i,t,P}}$	= Annual mean indirect nitrous oxide emissions due to manure deposition in the baseline scenario for sample unit i in year t (t CO_2e/ha).
$N2O\_md_{bsl,volat,i,t}$	= Indirect nitrous oxide emissions produced from atmospheric deposition of N volatilized due to manure deposition for sample unit i in year t (t CO_2e).
$N2O\_md_{bsl,leach,i,t}$	= Indirect nitrous oxide emissions produced from leaching and runoff of N, in regions where leaching and runoff occurs, as a result of manure deposition for sample unit i in year t. Equal to zero where annual precipitation is less than potential evapotranspiration, unless irrigation is employed (t CO_2e).

Nitrous Oxide Emissions from Biomass Burning

Project activities will not result in a significant increase in biomass burning. Biomass burning has been found to be de minimis and therefore it is not included. Supporting evidence has been given to the validator.

All parameters used in the above equations are defined in Sections 5.1 and 5.2.

4.2 Project Emissions

Soil Organic Carbon

Soil organic carbon (SOC) will be quantified using Quantification Approach 1, Equation 6, as defined in VM0042 Section 8.2.1, using the DayCent model. DayCent is a process-based and publicly available model, which is commonly used to simulate changes in SOC and GHG fluxes over time. Accurate simulations are obtained at the field and soil strata-level using farm data, given different ecosystem and management scenarios.

For SOC in the project scenario, all DayCent model settings will remain the same as the baseline scenario, except for specific management changes to be undertaken by the project. For each soil strata, we run DayCent for the full timeseries for a business-as-usual baseline scenario and again for the selected practice changes in the project scenario. The difference in total SOC will be tracked in grams per meter and converted to a combined change in CO2e/hectare.

Equation (6):

$$SOC_{wp,i,t} = f\left(SOC_{wp,i,t}\right)$$

Where:

$SOC_{wp,i,t}$	= Estimated carbon stocks in the SOC pool in the project scenario for sample unit i at the end of year t (t CO2e/ha).
$f\left(SOC_{wp,i,t}\right)$	= Modeled SOC stocks in the project scenario for sample unit i in year t, calculated by modeling SOC stock changes over the course of the preceding year (t CO2e/ha).
i	= Sample unit.

Carbon Dioxide Emissions from Fossil Fuels

Project activities will not result in a significant increase in the use of fossil fuels. Fossil fuel usage has been found to be de minimis and therefore it is not included.. See section 3.3- Project Boundary for further details on the exclusion of emissions from fossil fuels in the project and baseline scenario.

Carbon Dioxide Emissions from Woody Biomass

Project activities will not result in increased woody biomass emissions. It has been found to be de minimis and therefore it is not included. Supporting evidence has been given to the validator.

Methane Emissions from the SOC Pool

Project activities will not result in an increase in methane emissions from the SOC pool. Soil methanogenesis has been found to be de minimis and therefore it is not included. Supporting evidence has been given to the validator.

Methane Emissions from Livestock Enteric Fermentation

Methane from livestock enteric fermentation in the project scenario will be calculated according to Equation 12, as outlined in VM0042 Section 8.2.6, using Quantification Approach 3. For ex-ante estimations, head of livestock is assumed to remain constant in the project scenario. As project data is collected during the monitoring phase, this data will be used for quantifying emissions, and any emissions from additional cattle heads will be accounted as leakage. The respective equation is listed below:

Equation (12):

$$\underline{CH4\_ent_{wp,i,t}} = \frac{\left(\frac{GWP_{CH4} \times \sum_{l=1}^{L} Pop_{wp,l,i,t,P} \times EF_{ent,l,P}}{1000}\right)}{A_i}$$

Where:

$CH4\_ent_{wp,i,t}$	= Annual mean methane emissions from livestock enteric fermentation in the project scenario for sample unit i in year t (t CO_2e/ha).
$Pop_{wp,l,i,t,P}$	= Population of grazing livestock of type l in sample unit i for productivity system P in year t in the project scenario (head numbers).
$EF_{ent,l,P}$	= Enteric fermentation emission factor for livestock type l in productivity system P (kg CH_4/(head × year)).
l	= Type of livestock.
P	= Productivity system.
1000	= Conversion factor from kg to t.

<u>Methane Emissions from Manure Deposition</u>

Methane emissions from manure deposition in the project scenario will be calculated according to Equations 13 and 14, as outlined in VM0042 Section 8.2.7, using Quantification Approach 3. The respective equations are listed below:

Equation (13):

$$\underline{CH4\_md_{wp,i,t}} = \frac{GWP_{CH4} \times \sum_{l=1}^{L} \left(Pop_{wp,l,i,t,P} \times VS_{l,i,t,P} \times AWMS_{l,i,t,P,S} \times EF_{CH4,md,l,P,S} \right)}{10^{6} \times A_{i}}$$

Where:

$\underline{CH4\_md_{wp,i,t}}$ = Project annual mean CH_4 emissions from manure deposition in the project scenario for sample unit i in year t (t CO_2e/ha).

$VS_{l,i,t,P}$ = Average volatile solids excretion per head for livestock type l in sample unit i for productivity system P in year t (kg volatile solids/(head × day).

$AWMS_{l,i,t,P,S}$ = Fraction of total annual volatile solids for each livestock type l in sample unit i, that is managed in manure management system S in the project area, for productivity system P (dimensionless).

$EF_{CH4,md,l,P,S}$ = Emission factor for methane emissions from manure deposition for livestock type l for productivity system P in manure management system S (g CH_4/(kg volatile solids)).

S = Manure management system.

10^{6} = Conversion factor from grams to tonnes.

Equation (14):

$$VS_{l,i,t,P} = \left(VS_{rate,l,P} \times \frac{W_{wp,l,i,t,P}}{1000} \right) \times 365$$

Where:

$VS_{rate,l,P}$ = Default volatile solids excretion rate for livestock type l for productivity system P (kg volatile solids/(1000 kg animal mass × day)).

$W_{wp,l,i,t,P}$ = Average weight in the project scenario of livestock type l for sample unit i in productivity system P in year t (kg animal mass/head).

1000 = Conversion factor kg per tonne.

365 = Days per year.

<u>Methane Emissions from Biomass Burning</u>

Project activities will not result in a significant increase in biomass burning. Biomass burning has been found to be de minimis and therefore it is not included. Supporting evidence has been given to the validator.

Nitrous Oxide Emissions from Nitrogen Fertilizers and Nitrogen-Fixing Species

Nitrous oxide emissions from nitrogen fertilizer and nitrogen-fixing species in the project scenario will be calculated, according to Equations 17- 26, as outlined in VM0042 Section 8.2.9, using Quantification Approach 3.

The Equation 17 summarizes the calculation of emissions due to nitrogen inputs to soil, and it is indicated below:

Equation (17):

$$N2O\_soil_{wp,i,t} = N2O\_fert_{wp,i,t} + N2O\_md_{wp,i,t} + N2O\_Nfix_{wp,i,t}$$

Where:

$N2O\_soil_{wp,i,t}$ = Nitrous oxide emissions due to nitrogen inputs to soils in the project scenario for sample unit i in year t (t CO_2e/ha).

$N2O\_fert_{wp,i,t}$ = Nitrous oxide emissions due to fertilizer use in the project scenario for sample unit i in year t (t CO_2e/ha).

$N2O\_md_{wp,i,t}$ = Nitrous oxide emissions due to manure deposition in the project scenario for sample unit i in year t (t CO_2e/ha).

$N2O\_Nfix_{wp,i,t}$ = Nitrous oxide emissions from crop residues due to the use of N-fixing species in the project scenario for sample unit i in year t (t CO_2e/ha).

Equation 18 summarizes how emissions from fertilizer and manure application are quantified. The equation is listed below:

Equation (18):

$$N2O\_fert_{wp,i,t} = N2O\_fert_{wp,direct,i,t} + N2O\_fert_{wp,indirect,i,t}$$

Where:

$N2O\_fert_{wp,direct,i,t}$ = Direct nitrous oxide emissions due to fertilizer use in the project scenario for sample unit i in year t (t CO_2e/ha).

$N2O\_fert_{wp,indirect,i,t}$ = Indirect nitrous oxide emissions due to fertilizer use in the project scenario for sample unit i in year t (t CO_2e/ha).

Equations 19-21 indicate how direct nitrous oxide emissions due to fertilizer use are quantified. The respective equations are listed below:

Equation (19):

$$\underline{N2O\_fert_{wp,direct,i,t}} = \frac{\left(\left(FSN_{wp,i,t} + FON_{wp,i,t}\right) \times EF_{Ndirect} \times \frac{44}{28} \times GWP_{N2O}\right)}{A_i}$$

Equation (20):

$$FSN_{wp,i,t} = \sum_{SF} M_{bsl,SF,i,t} \times NC_{SF}$$

Equation (21):

$$FON_{wp,i,t} = \sum_{ON} M_{bsl,ON,i,t} \times NC_{ON}$$

Where:

$N2O\_fert_{wp,direct,i,t}$	= Annual mean direct nitrous oxide emissions due to fertilizer use in the project scenario for sample unit i in year t (t CO_2e/ha).
$FSN_{wp,i,t}$	= Synthetic N fertilizer applied to sample unit i in year t in the project scenario (t N)
$FON_{wp,i,t}$	=Organic N fertilizer applied to sample unit i in year t in the project scenario (t N).
$EF_{Ndirect}$	= Emission factor for nitrous oxide emissions from N additions from synthetic fertilizers, organic amendments and crop residues (t N_2ON/t N applied).
$M_{wp,SF,i,t}$	= Mass of N-containing synthetic fertilizer type SF applied to sample unit i in year t in the project scenario (t fertilizer).
NC_{SF}	= N content of synthetic fertilizer type SF (t N/t fertilizer).
$M_{wp,ON,i,t}$	= Mass of N-containing organic fertilizer type OF applied to sample unit i in year t in the project scenario (t fertilizer).
NC_{ON}	= N content of organic fertilizer type OF (t N/t fertilizer).
SF	= Synthetic N fertilizer type.
OF	= Organic N fertilizer type.
$\frac{44}{28}$	= Molar mass ratio of N_2O to N applied to convert N_2O-N emissions to N_2O emissions.

Equations 22-24 indicate how indirect nitrous oxide emissions due to fertilizer use are quantified. The respective equations are listed below:

Equation (22):

$$\underline{N2O\_fert_{wp,indirect,i,t}} = \frac{\left(N2O\_fert_{wp,volat,i,t} + N2O\_fert_{wp,leach,i,t}\right)}{A_i}$$

Equation (23):

$$N2O\_fert_{wp,volat,i,t} = \left[\left(FSN_{wp,i,t} \times FRAC_{GASF}\right) + \left(FON_{wp,i,t} \times FRAC_{GASM}\right)\right] \times EF_{Nvolat} \times \frac{44}{28} \times GWP_{N2O}$$

Equation (24):

$$N2O\_fert_{wp,leach,i,t} = \left(FSN_{wp,i,t} + FON_{bsl,i,t}\right) \times FRAC_{leach} \times EF_{Nleach} \times \frac{44}{28} \times GWP_{N2O}$$

Where:

$N2O\_fert_{wp,indirect,i,t}$	= Annual mean indirect nitrous oxide emissions due to fertilizer use in the project scenario for sample unit i in year t (t CO_2e/ha).
$N2O\_fert_{wp,volat,i,t}$	= Indirect nitrous oxide emissions produced from atmospheric deposition of N volatilized due to fertilizer use in the project scenario in sample unit i in year t (t CO_2e).
$N2O\_fert_{wp,leach,i,t}$	= Indirect nitrous oxide emissions produced from leaching and runoff of N, in regions where leaching and runoff occurs, due to fertilizer use in the project scenario in sample unit i in year t (t CO_2e).
$FRAC_{GASF}$	= Fraction of all synthetic N added to soils that volatilizes as NH_3 and NOx (kg N volatilized/kg N applied).
$FRAC_{GASM}$	= Fraction of all organic N added to soils and N in manure and urine deposited on soils that volatilizes as NH_3 and NOx (kg N volatilized/kg N applied).
EF_{Nvolat}	= Emission factor for nitrous oxide emissions from atmospheric deposition of N on soils and water surfaces (t N_2O-N/(t NH_3-N + NOxN volatilized)).
$FRAC_{leach}$	= Fraction of N (synthetic or organic) added to soils and in manure and urine deposited on soils that is lost through leaching and runoff, in regions where leaching and runoff occurs, for manure management system S and livestock type I (kg N/kg N additions).
EF_{Nleach}	= Emission factor for nitrous oxide emissions from leaching and runoff (t N_2O-N/t N leached and runoff).

For ex-ante emissions estimates a 15% reduction was applied to $N20\_fert_{wp,volat,it}$ and $N20\_fert_{wp,leach,it}$ for instances implementing nitrogen optimization. This 15% reduction was derived from the *Quantification Protocol for Agricultural Nitrous Oxide Emission Reductions* from the Alberta Protocol (page 9 table 1). This will be used for ex-ante emission estimates only.

In case any nitrous oxide emissions due to the use of N-fixing species occur, they will be quantified following Equations 25 and 26. The respective equations are listed below:

Equation (25):

$$\underline{N2O\_Nfix}_{wp,i,t} = \frac{\left(F_{CR,wp,i,t} \times EF_{Ndirect} \times \frac{44}{28} \times GWP_{N2O}\right)}{A_i}$$

Where:

$\underline{N2O\_Nfix}_{wp,i,t}$ = Annual mean nitrous oxide emissions from crop residues due to the use of N-fixing species in the project scenario for sample unit i in year t (t CO_2e/ha).

$F_{CR,wp,i,t}$ = Amount of N in N-fixing species (above- and belowground) returned to soils in the project scenario for sample unit i in year t (t N).

Equation (26):

$$F_{CR,wp,i,t} = \sum_{g=1}^{G} MB_{g,wp,i,t} \times N_{content,g}$$

Where:

$MB_{g,bsl,i,t}$ = Annual dry matter (above- and belowground) of N-fixing species g returned to soils for sample unit i in year t (t dm).

$N_{content,g}$ = Fraction of N in dry matter for N-fixing species g (t N/t dm).

g = Type of N-fixing species.

Parameter	Value	Unit	Description	Source
Ai	13.86	ha	PAI size in hectares	Farm attestation
Organic N fertiliser name	Poultry layer manure	-	Organic fertiliser name, if any	Farm attestation
Mwp,ON,i,t	69.3	t fertiliser	Mass of organic fertiliser, if any	Farm atttestation
NCON	0.019	-	N content of organic fertiliser	Based on literature

FONwp	1.32	t N	N inputs from organic fertiliser	Equation 21 in VM0042 v 2.0
FSNwp	0	t N	N inputs from synthetic fertiliser	Farm attestation
GWPN2O	265	t CO2e/t N2O	Global warming potential for N2O	Page 84 in VM0042 v 2.0
EFNdirect	0.01	t N2O-N/t N	Emission factor for nitrous oxide emissions from N additions from synthetic fertilisers, organic amendments and crop residues	Table 11.1 in 2019 IPCC Refinement*
FRACGASF	0.11	-	Fraction of all synthetic N added to soils that volatilizes	Table 11.1 in 2019 IPCC Refinement*
FRACGASM	0.21	-	Fraction of all organic N added to soils that volatilizes	Table 11.3 in 2019 IPCC Refinement*
EFNvolat	0.01	t N2O-N/t N	Emission factor for N2O emissions from atmospheric deposition of N on soils and water surfaces	Table 11.3 in 2019 IPCC Refinement*
FRACleach	0.24	-	Fraction of N that is lost through leaching and runoff	Table 11.3 in 2019 IPCC Refinement*
EFNleach	0.011	t N2O-N/t N	Emission factor for N2O emissions from leaching and runoff	Table 11.3 in 2019 IPCC Refinement*
gwp	Horse Beans	-	Name of N-fixing species	Farm attestation
Pwp,p	3.27	t Biomass/ha	Average crop productivity	Farm attestation
Crop residue management	Mulched	-	Implementation status of residue management	Farm attestation
DRY	0.91	-	Dry matter fraction of harvested product	Table 11.1A in 2019 IPCC Refinement*

Slope(t)	0.36	-	Default slope values in IPCC yield-to-residue equations	Table 11.2 in 2019 IPCC Refinement*
Intercept(t)	0.68	-	Default intercept values in IPCC yield-to-residue equations	Table 11.2 in 2019 IPCC Refinement*
RS(t)	0.19	-	Ratio of below-ground biomass to above-ground biomass	Table 11.1A in 2019 IPCC Refinement*
Ncontent,g (NAGT)	0.008	-	N content of above-ground residues	Table 11.1A in 2019 IPCC Refinement*
Ncontent,g (NBGT)	0.008	-	N content of below-ground residues	Table 11.1A in 2019 IPCC Refinement*
N2O_fertwp,direct	0.396	t CO2e/ha	Areal mean direct N2O emissions due to fertiliser use	Equation 19 in VM0042 v 2.0
N2O_fertwp,volat	1.151	t CO2e	Indirect N2O emissions produced from atmospheric deposition of N volatilized	Equation 23 in VM0042 v 2.0
N2O_fertwp,leach	1.448	t CO2e	Indirect N2O emissions produced from leaching and runoff of N	Equation 24 in VM0042 v 2.0
N2O_fertwp,indirect	0.188	t CO2e/ha	Areal mean indirect N2O emissions due to fertiliser use	Equation 22 in VM0042 v 2.0
N2O_fertwp	0.58	t CO2e/ha	Areal mean N2O emissions due to fertiliser use	Equation 18 (VM0042 v 2.0)
MBg,wp (MBagwp)	14.86	t dm	Annual dry matter above-ground residues returned to the soil	Equations 11.6 and 11.7 and Table 11.2 in 2019 IPCC Refinement*
MBg,wp (MBdgwp)	10.66	t dm	Annual dry matter below-ground residues returned to the soil	Equations 11.6 and 11.7 and Table 11.2 in 2019 IPCC Refinement*
MBag_N,wp	0.119	t N	Total N inputs from above-ground residues	Equation 26 (VM0042 v 2.0)

MBdg_N,wp	0.085	t N	Total N inputs from below-ground residues	Equation 26 (VM0042 v 2.0)
FCR,wp	0.204	t N	Amount of N in N-fixing species (above- and belowground) returned to soils	Sum of total N inputs from above-ground residues (MBag_Nwp) and below-ground residues (MBbg_Nwp)
N2O_Nfixwp	0.06	t CO2e/ha	Areal mean N2O emissions from crop residues of N-fixing species	Equation 25 (VM0042 v 2.0)
N2O_soilwp	0.64	t CO2e/ha	Total N2O emissions from soil	Equation 17 (VM0042 v 2.0)

Nitrous Oxide Emissions from Manure Deposition

Nitrous oxide emissions from manure deposition in the baseline scenario will be calculated according to Equations 27-32, as outlined in VM0042 Section 8.2.10, using Quantification Approach 3. The respective equations are indicated below.

Equation (27):

$$\underline{N2O\_md_{wp,i,t}} = N2O\_md_{wp,direct,i,t} + N2O\_md_{wp,indirect,i,t}$$

Where:

$\underline{N2O\_md_{wp,i,t}}$ = Annual mean nitrous oxide emissions due to manure deposition in the project scenario for sample unit i in year t (t CO_2e/ha).

$N2O\_md_{wp,direct,i,t}$ = Direct nitrous oxide emissions due to manure deposition in the project scenario for sample unit i in year t (t CO_2e/ha).

$N2O\_md_{wp,indirect,i,t}$ = Indirect nitrous oxide emissions due to manure deposition in the project scenario for sample unit i in year t (t CO_2e/ha).

Equation (28):

$$\underline{N2O\_md_{wp,direct,i,t,P}} = \frac{\sum_{l=1}^{L} F_{wp,manure,l,i,t,P} \times EF_{N2O,md,l,S} \times \frac{44}{28} \times GWP_{N2O}}{A_i}$$

Equation (29):

$$F_{wp,manure,l,i,t,P} = 1000 \times \left[\left(Pop_{wp,l,i,t} \times Nex_{l,P} \right) \times AWMS_{l,i,t,P,S} \times MS_{wp,l,t,t} \right]$$

Where:

$\underline{N2O\_md_{wp,direct,i,t,P}}$ = Annual mean direct nitrous oxide emissions due to manure deposition in the project scenario for sample unit i for productivity system P and manure management system S in year t (t CO_2e/ha).

$F_{wp,manure,l,i,t,P}$ = Amount of nitrogen in manure and urine deposited on soils by livestock type l for productivity system P in sample unit i in year t (kg N).

$Nex_{l,P}$ = Average annual nitrogen excretion per head of livestock type l for productivity system P (kg N deposited/(head × year)).

$EF_{N2O,md,l,S}$ = Emission factor for nitrous oxide from manure and urine deposited on soils by livestock type l for manure management system S (kg N2O-N/kg N input).

$MS_{wp,l,t,t}$ = Project fraction of total annual N excretion for each livestock type l for sample unit i in year t that is deposited on the project area (%).

1000 = Conversion factor from kg to t.

Equation (30):

$$\underline{N2O\_md_{wp,indirect,i,t}} = \frac{\left(N2O\_md_{wp,volat,i,t} + N2O\_md_{wp,leach,i,t} \right)}{A_i}$$

Equation (31):

$$N2O\_md_{wp,volat,i,t} = F_{wp,manure,l,i,t,P} \times FRAC_{GASM} \times EF_{Nvolat} \times \frac{44}{28} \times GWP_{N2O}$$

Equation (32):

$$N2O\_md_{wp,leach,i,t} = F_{wp,manure,l,i,t,P} \times FRAC_{LEACH} \times EF_{Nleach} \times \frac{44}{28} \times GWP_{N2O}$$

Where:

$N2O\_md_{wp,indirect,i,t,P}$	= Annual mean indirect nitrous oxide emissions due to manure deposition in the project scenario for sample unit i in year t (t CO_2e/ha).
$N2O\_md_{wp,volat,i,t}$	= Indirect nitrous oxide emissions produced from atmospheric deposition of N volatilized due to manure deposition for sample unit i in year t (t CO_2e).
$N2O\_md_{wp,leach,i,t}$	= Indirect nitrous oxide emissions produced from leaching and runoff of N, in regions where leaching and runoff occurs, as a result of manure deposition for sample unit i in year t. Equal to zero where annual precipitation is less than potential evapotranspiration, unless irrigation is employed (t CO_2e).

Nitrous Oxide Emissions from Biomass Burning

Project activities will not result in a significant increase in biomass burning. Biomass burning has been found to be de minimis and therefore it is not included. Supporting evidence has been given to the validator.

All parameters used in the above equations are defined in Sections 5.1 and 5.2.

4.3 Leakage Emissions

This project does not cause GHG emissions to change outside of the project boundary as a result of the adopted practices or changes to existing practices. Potential leakage for the project boundaries will be accounted for according to VM0042 Section 8.4.1. The Agoro Carbon Ready USA project will manage leakage activities for the following scenarios:

Carbon application displacement (manure, biosolids, compost)

When carbon-based applications are obtained from outside the project area, or from a source that was previously used to provide methane capture or soil amendments for other farms (i.e. was previously destined for another use besides waste), a deduction for that displaced carbon will be calculated to align with Equation 28 from VM0042 Section 8.4.1.

Equation (28):

$$LE_{OA,t} = \sum_{t}\left(M\_OA_{wp,l,t} \times CC_{wpoa,t} \times 0.12 \times \frac{44}{12}\right)$$

Where:

$LE_{OA,t}$ = Leakage from organic amendments in year t (t CO_2e).

$M\_OA_{wp,l,t}$ = Mass of organic amendment applied as fertilizer in the project area in year t (tonnes).

$CC_{wpoa,t}$ = Carbon content of organic amendment applied as fertilizer in the project area in year t (t C/t organic amendment).

0.12 = Fraction of manure (i.e., organic amendment) carbon expected to remain in project area soils (unitless).

$\frac{44}{12}$ = Ratio of molecular weight of carbon dioxide to carbon.

Livestock displacement

Emissions due to livestock displacement, if happen, will be accounted for. The number of cattle heads will be monitored.

Biomass Residues

Emissions due to the diversion of biomass residues will not occur as it is not permissible in our program. We specifically monitor the purchase of biomass to ensure it is not being purchased from sources that would have captured or converted methane emissions. This monitoring effort is made clear in our evidence collected from farmers who provide receipts of purchase.

Declines in productivity

Although it is not anticipated to be a problem over the project lifetime, yield can sometimes decline as a result of newly instituted regenerative practices (as described in Section 3.5 Additionality). If it occurs, the quantification methods outlined in VM0042 Section 8.4.3 will account for this paradigm and be managed with the collection of yield data. If yield decreases by more than 5% per field over the quantification period, excluding outlier climatic events, the following steps will be taken to account for the decrease:

Step 1. Using yield data, calculate the change in productivity per enrolled fields per farm according to Equation 29 in VM0042 Section 8.4.3.

Equation (29):

$$\Delta P = \left(\frac{P_{wp,p} - P_{bsl,p}}{P_{bsl,p}}\right) \times 100$$

Where:

ΔP = Change in productivity; percent.

Pwp,p = Average productivity for product p during the project period; productivity per hectare or acre

$Pbsl,p$ = Average productivity for product p during the historical baseline period; productivity per hectare or acre.

p = crop/livestock product.

Step 2. If productivity has declined by more than 5%, recalculate the first step excluding the first 3 years of data post-project implementation, i.e. compare the historical productivity with only the most recent data from the project.

Step 3. If the calculation in step 2 still demonstrates a loss in productivity greater than 5%, perform a multi regression analysis to determine the root cause of the decrease in productivity. If no single variable can be determined to be causal, then the field becomes ineligible for carbon crediting.

However, if a particular regenerative practice can be determined as the principal agent responsible for the decrease, then the field can still be eligible for a carbon credit after application of an alternative regenerative practice.

4.4 Estimated GHG Emission Reductions and Carbon Dioxide Removals

Net GHG emission removals and reductions will be quantified following the equations and procedures described in in VM0042 Section 8.5.

Net GHG emission reductions will be calculated according to equation 37, as indicated below.

Equation (37):

$$E_{red,t} = \Delta CO2\_ff_t + \Delta CO2\_lime_t + \Delta CH4\_ent_t + \Delta CH4\_md_t + \Delta CH4\_bb_t + \left(\Delta CH4\_soil_t \times \left(1 - UNC_{t,CH4\_soil}\right)\right) + \left(\left(\Delta N2O\_soil_t \times \left(1 - UNC_{t,N2O\_soil}\right)\right)\right) + \Delta N2O\_bb_t$$

Where:

$E_{red,t}$ = Estimated net GHG emissions reductions in year t (t CO_2e).

$\Delta CO2\_ff_t$ = Total carbon dioxide emission reductions from fossil fuel combustion in year t (t CO_2e).

$\Delta CO2\_lime_t$ = Total carbon dioxide emission reductions from liming in year t (t CO_2e).

$\Delta CH4\_ent_t$ = Total methane emission reductions from livestock enteric fermentation in year t (t CO_2e).

$\Delta CH4\_md_t$ = Total methane emission reductions from manure deposition in year t (t CO_2e).

$\Delta CH4\_bb_t$ = Total methane emission reductions from avoided or reduced biomass burning in year t (t CO_2e).

$\Delta CH4\_soil_t$ = Total methane emission reductions from increasing uptake into the SOC pool in year t (t CO_2e).

$UNC_{t,CH4\_soil}$ = Uncertainty deduction in year t when using Quantification Approach 1 to model methane emission reductions from increasing uptake into the SOC pool (fraction between 0 and 1).

$\Delta N2O\_soil_t$ = Total nitrous oxide emission reductions from nitrification/denitrification in year t (t CO_2e).

$UNC_{t,N2O\_soil}$ = Uncertainty deduction in year t when using Quantification Approach 1 to model nitrous oxide emission reductions from nitrification/denitrification (fraction between 0 and 1).

$\Delta N2O\_bb_t$ = Total nitrous oxide emission reductions from avoided or reduced biomass burning in year t (t CO_2e).

Net GHG emission removals will be calculated according to equation 38, as indicated below.

Equation (38):

$$E_{rem,t} = \left(\left(\Delta CO2_{soil,t} - LE_{OA,t} - LE_{BR,t}\right) \times \left(1 - UNC_{t,CO2}\right)\right) + \Delta C_{TREE,t} + \Delta C_{SHRUB,t}$$

Where:

$E_{rem,t}$ = Estimated net GHG emissions removals in year t (t CO_2e).

$\Delta CO2_{soil,t}$ = Total carbon dioxide emission removals from increasing the SOC pool in year t (t CO_2e).

$LE_{BR,t}$ = Leakage emissions from the diversion of manure or crop residues from baseline energy applications in year t (t CO_2e).

$\Delta C_{TREE,t}$= Total carbon dioxide emission removals from increasing tree biomass in year t (t CO_2e).

$\Delta C_{SHRUB,t}$ = Total carbon dioxide emission removals from increasing shrub biomass in year t (t CO_2e).

$UNC_{t,CO2}$ = Uncertainty deduction in year t associated with modeling or measuring SOC stock changes (fraction between 0 and 1).

Net GHG emission reductions and removals will be calculated according to equation 39, as indicated below.

Equation (39):

$$ERR_t = E_{red,t} + E_{rem,t}$$

Where:

ERR_t = Estimated net GHG emissions reductions and removals in year t (t CO_2e).

Carbon Dioxide emission Reductions and Removals

Carbon dioxide emission reductions and removals will be calculated according to equation 40 listed below.

Equation (40):

$$\Delta CO2\_soil_{t} = \sum_{i=1}^{n}\left(\left(\underline{SOC}_{wp,i,t} - \underline{SOC}_{wp,i,t-1}\right) - \left(\underline{SOC}_{bsl,i,t} - \underline{SOC}_{bsl,i,t-1}\right)\right) \times A_{i}$$

Where:

$\underline{SOC}_{wp,i,t}$ = Areal mean carbon stocks in the SOC pool in the project scenario for sample unit i at the end of year t (t CO_2e /ha).

$\underline{SOC}_{wp,i,t-1}$ = Areal mean carbon stocks in the SOC pool in the project scenario for sample unit i at the end of year t − 1 (t CO_2e/ha).

$\underline{SOC}_{bsl,i,t}$ = Areal mean carbon stocks in the SOC pool in the baseline scenario for sample unit i at the end of year t (t CO_2e/ha).

$\underline{SOC}_{bsl,i,t-1}$ = Areal mean carbon stocks in the SOC pool in the baseline scenario for sample unit i at the end of year t − 1 (t CO_2e/ha).

Carbon dioxide emission reductions from fossil fuel combustion and removals from tree and shrub biomass are considered de minimis and, thus, not included in this document.

Parameter	Value	Unit	Description	Source
Ai	13.86	ha	PAI size in hectares	Farm attestation
SOCbsl,i,t	65.185	t C/ha	Areal mean SOC in the baseline scenario at the end of year t	Equation 6 (VM0042 v 2.0)
SOCbsl,i,t-1	67	t C/ha	Areal mean SOC in the baseline scenario at the end of year t-1	Equation 6 (VM0042 v 2.0)
SOCwp,i,t	65.403	t C/ha	Areal mean SOC in the project scenario at the end of year t	Equation 6 (VM0042 v 2.0)
SOCwp,i,t-1	67	t C/ha	Areal mean SOC in the baseline scenario at the end of year t-1	Equation 6 (VM0042 v 2.0)
ΔCO2_soilt	11.1	t CO2e	Change in soil organic carbon in year t	Equation 40 (VM0042 v 2.0)

Methane Emission Reductions

Methane emission reductions from SOC pool and avoided or reduced biomass burning are considered de minimis and, thus, not included in this section.

Methane emission reductions from livestock enteric fermentation and manure deposition will be calculated according to equations 46 and 47, respectively.

Equation (46):

$$\Delta CH4\_ent_t = \sum_{i=1}^{n} \left(\underline{CH4\_ent}_{bsl,i,t} - \underline{CH4\_ent}_{wp,i,t} \right) \times A_i$$

Where:

$\underline{CH4\_ent}_{bsl,i,t}$ = Areal mean methane emissions from livestock enteric fermentation in the baseline scenario for sample unit i in year t (t CO_2e/ha)

$\underline{CH4\_ent}_{wp,i,t}$ = Areal mean methane emissions from livestock enteric fermentation in the project scenario for sample unit i in year t (t CO_2e/ha).

Equation (47):

$$\Delta CH4\_md_t = \sum_{i=1}^{n} \left(\underline{CH4\_md}_{bsl,i,t} - \underline{CH4\_md}_{wp,i,t} \right) \times A_i$$

Where:

$\underline{CH4\_ent}_{bsl,i,t}$ = Areal mean methane emissions from manure deposition in the baseline scenario for sample unit i in year t (t CO_2e/ha)

$\underline{CH4\_ent}_{wp,i,t}$ = Areal mean methane emissions from manure deposition in the project scenario for sample unit i in year t (t CO_2e/ha).

Nitrous Oxide Emission Reductions

Nitrous oxide emission reductions from nitrification/denitrification, nitrogen fixing species and manure deposition will be quantified as in equation 49 displayed below.

Equation (49):

$$\Delta N2Osoil_t = \sum_{i=1}^{n} \left(\underline{N2O_{soil,bsl,i,t}} - \underline{N2O_{soil,wp,i,t}} \right) \times A_i$$

Where:

$\underline{N2O_{soil,bsl,i,t}}$ = Annual mean nitrous oxide emissions from nitrogen inputs to soils in the baseline scenario for sample unit i in year t (t CO_2e/ha).

$\underline{N2O_{soil,wp,i,t}}$ = Annual mean nitrous oxide emissions from nitrogen inputs to soils in the project scenario for sample unit i in year t (t CO_2e/ha).

Nitrous oxide emission reductions from biomass burning are considered de minimis and, thus, not included in this section.

Parameter	Value	Unit	Description	Source
Ai	13.86	ha	PAI size in hectares	Farm attestation
N2Osoil,bsl,i,t	1.32	t CO2e/ha	Areal mean N2O emissions from soil in the baseline emissions	Calculation as discussed in Section 4.1.4 of PD
N2Osoil,wp,i,t	0.64	tCO2e/ha	Areal mean N2O emissions from soil in the project emissions	Calculation as discussed in Section 4.2.5 of PD
ΔN2Osoilt	9.4	t CO2e	N2O emission reductions from nitrification/ denitrification in soil	Equation 49 (VM0042 v 2.0)

State the non-permanence risk rating (%)	22%
Has the non-permanence risk report been attached as either an appendix or a separate document?	☒ Yes ☐ No
For ARR and IFM projects with harvesting, state, in tCO_2e, the Long-term Average (LTA).	N/A
Has the LTA been updated based on monitored data, if applicable?	N/A
State, in tCO_2e, the expected total GHG benefit to date.	139,452 tCO2e (by end of 2023)
Is the number of GHG credits issued below the LTA?	N/A

The following table represents VCUs for the initial set of project instances included into the PDD:

Vintage period	Estimated baseline emissions (tCO_2e)	Estimated project emissions (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated buffer pool allocation (tCO_2e)	Estimated reduction VCUs (tCO_2e)	Estimated removal VCUs (tCO_2e)	Estimated total VCU issuance (tCO_2e)
20-March 2021 to 31-Dec-2021	72,680	41,788	0	3,975	12,822	14,094	26,916
01-Jan 2022 to 31-Dec-2022	92,432	53,145	0	5,056	16,307	17,925	34,232
01-Jan 2023 to 31-Dec-2023	130,006	60,734	0	9,859	24,461	34,953	59,414
01-Jan 2024 to 31-Dec-2024	167,580	68,323	0	14,662	32,614	51,982	84,596
01-Jan 2025 to 31-Dec-2025	205,154	75,911	0	19,464	40,768	69,010	109,778
01-Jan 2026 to 31-Dec-2026	242,727	83,500	0	24,267	48,921	86,039	134,960
01-Jan 2027 to 31-Dec-2027	280,301	91,089	0	29,070	57,075	103,067	160,142

01-Jan 2028 to 31-Dec-2028	317,875	98,678	0	33,873	65,228	120,096	185,324
01-Jan 2029 to 31-Dec-2029	355,448	106,266	0	38,676	73,382	137,124	210,506
01-Jan 2030 to 31-Dec-2030	393,022	113,855	0	43,479	81,535	154,153	235,688
01-Jan 2031 to 31-Dec-2031	430,596	121,444	0	48,282	89,689	171,181	260,870
01-Jan 2032 to 31-Dec-2032	468,170	129,033	0	53,085	97,842	188,210	286,052
01-Jan 2033 to 31-Dec-2033	505,743	136,621	0	57,888	105,996	205,238	311,234
01-Jan 2034 to 31-Dec-2034	543,317	144,210	0	62,691	114,149	222,267	336,416
01-Jan 2035 to 31-Dec-2035	580,891	151,799	0	67,494	122,303	239,296	361,598
01-Jan 2036 to 31-Dec-2036	618,464	159,388	0	72,297	130,456	256,324	386,780
01-Jan 2037 to 31-Dec-2037	656,038	166,977	0	77,099	138,610	273,353	411,962
01-Jan 2038 to 31-Dec-2038	693,612	174,565	0	81,902	146,763	290,381	437,144
01-Jan 2039 to 31-Dec-2039	731,186	182,154	0	86,705	154,917	307,410	462,326

01-Jan 2040 to 31-Dec-2040	768,759	189,743	0	91,508	163,070	324,438	487,508
01-Jan 2041 to 19-March-2041	172,312	42,170	0	20,582	36,590	72,971	109,561
Total	8,426,313	2,391,392	0	**941,914**	1,753,494	3,339,513	**5,093,007**

5 QUANTIFICATION OF ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Data and Parameters Available at Validation

Data / Parameter	AR
Data unit	Percent
Description	Weighted mean adoption rate
Source of data	Calculated for the project across all activity instances, see file named "Common practice_USA_PDD cropland_final draft.xlsx"
Value applied	Calculated for the project across all activity instances, see file named "Common practice_USA_PDD_final draft.xlsx". Less than 20%. US State — Weighted Adoption Rate, AR, in % California 7.9% Colorado 4.8% Idaho 2.4% Illinois 19.6% Indiana 10.4% Iowa 9.9% Kansas 14.0% Minnesota 0.6% Missouri 0.3%

	Nebraska 6.7% North Dakota 0.1% Oregon 6.7% South Dakota 4.3% Texas 4.2% Washington 5.1% Wisconsin 2.8%
Justification of choice of data or description of measurement methods and procedures applied	Calculated value – equation 1 of the methodology. Calculated based on the area of proposed project-level adoption of each activity
Purpose of Data	Assessment of the common practice
Comments	Eligibility criteria for the demonstration of additionality on project activity instance level are demonstrated by criterion 10 listed in Section 1.4 of PDD.

Data / Parameter	$Area_{ay}$
Data unit	Hectares
Description	Area of proposed project-level adoption of activity ay
Source of data	Project database on the number of hectares enrolled in the Programme
Value applied	See the file "Common practice USA PDD cropland final draft.xlsx" outlining area for each practice/mix of practices and US state. The value for the parameter will change in the future due to the inclusion of new project activity instances in the project.
Justification of choice of data or description of measurement methods and procedures applied	Fixed value for initial group of project instances. Calculation is based on the projects records - based on the values specified in contracts with farmers (SalesForce)
Purpose of Data	Assessment of the common practice
Comments	Eligibility criteria for the demonstration of additionality on project activity instance level are demonstrated by criterion 10 listed in Section 1.4 of PDD. Cross-check of the field areas with GIS/remote sensing data with be performed. Area of fields adopting new practices is determined from shapefiles for field boundaries of new project instances enrolled in the project. Field boundaries are checked and adjusted as needed by Agoro to ensure that a consistent coordinate reference system and projection are used and only eligible hectares are included.

Data / Parameter	$EAay$
Data unit	Percent
Description	Adoption rate of the y most common (by area covered) proposed project activity in the region
Source of data	Soil Enrichment protocol (SEP), Additionality tool, available at https://www.climateactionreserve.org/how/protocols/soil - enrichment/
Value applied	Since adoption rates are determined for each project practice/mix of practices in each state, there are numerous different values. Values are provided in calculation file „Common practice_USA_PDD_cropland_final draft.xlsx“
Justification of choice of data or description of measurement methods and procedures applied	N/A, fixed value for initial group of project instances.
Purpose of Data	Assessment of the common practice
Comments	Eligibility criteria for the demonstration of additionality on project activity instance level are demonstrated by criterion 10 listed in Section 1.4 of PDD.

Data / Parameter	a_Y
Data unit	unitless
Description	Proposed project activity commitments a1 to ay, where a1 covers the largest area in the project region
Source of data	Project records on activities (per practice/practice mix) to be implemented in the project
Value applied	Since adoption rates are determined for each project practice/mix of practices in each state, there are numerous different values. Values are provided in calculation file “Common practice_USA_PDD_cropland_final draft.xlsx“. The values include project practices or mix of project practices in different constellations.
Justification of choice of data or description of measurement methods and procedures applied	N/A, fixed value for initial group of project instances.
Purpose of Data	Assessment of the common practice, basis for parameters $Area_{ay}$ and PA_{ay}
Comments	Eligibility criteria for the demonstration of additionality on project activity instance level are demonstrated by criterion 10 listed in Section 1.4 of PDD.

Data / Parameter	GWP_{CH4}
Data unit	t CO_2e/t CH_4
Description	Global warming potential for CH_4
Source of data	IPCC Fifth Assessment Report, 100-year global warming potential derived from the IPCC Fourth Assessment Report

Value applied	28
Justification of choice of data or description of measurement methods and procedures applied	IPCC Fifth Assessment Report, 100-year global warming potential derived from the IPCC Fourth Assessment Report
Purpose of Data	Calculation of baseline and project emissions
Comments	None

Data / Parameter	GWP_{N2O}
Data unit	t CO_2e/t N_2O
Description	Global warming potential for N_2O
Source of data	IPCC Fifth Assessment Report, 100-year global warming potential derived
Value applied	265
Justification of choice of data or description of measurement methods and procedures applied	Default value according to IPCC Fifth Assessment Report
Purpose of Data	Calculation of baseline and project emissions
Comments	None

Data / Parameter	$M_{bsl,SF,i,t}$
Data unit	t fertilizer
Description	Mass of N-containing synthetic fertilizer type SF applied in sample unit i in year t in the baseline scenario
Source of data	Determined in sampling unit i from farmer provided management practice information
Value applied	Specific for each farmer. Below, total values at project level are shown according to fertilizer type: Source not specified - 4227.21 t N MAP – 223.50 t fertilizer DAP – 13.51 t fertilizer Urea – 713.16 t fertilizer Anhydrous Ammonia – 1395.53 t fertilizer Ammonium Sulphate – 9.86 t fertilizer
Justification of choice of data or description of measurement	Depending on information availability, this parameter is collected directly from farmer's equipment that have systems that monitor the amount of fertilizer applied (e.g., My John Deere)Alternatively, information is collected via direct consultation with, and substantiated with a written attestation from, the grower or landowner of the sample unit. Any quantitative information (e.g., discrete or continuous numeric variables) on agricultural management practices is supported by one or more forms of documented evidence pertaining to the selected sample unit and relevant monitoring period (e.g., management logs, receipts or invoices, farm equipment specifications).
Purpose of Data	Calculation of baseline emissions

Comments	None

Data / Parameter	$M_{bsl,OF,i,t}$
Data unit	t fertilizer
Description	Mass of N-containing organic fertilizer type OF applied in the baseline scenario for sample unit i in year t
Source of data	Determined in sampling unit i from farmer provided management practice information
Value applied	Specific for each farmer Below, total values at project level are shown according to fertilizer type: Beef (bedded pack barn - solid manure) – 1,722.81 t fertilizer Beef (dirt lot - solid manure) – 949.43 t fertilizer Beef (paved lot - solid manure) – 762.91 t fertilizer Beef (slurry manure) – 2,745.79 t fertilizer Broiler (litter from house - solid manure) – 1,638.66 t fertilizer Dairy (lagoon - liquid effluent) – 2,966.90 t fertilizer Swine (finisher, wet - slurry manure) – 864.09 t fertilizer Swine (lagoon - liquid effluent) – 7,212.39 t fertilizer
Justification of choice of data or description of measurement	Depending on information availability, this parameter is collected directly from farmer's equipment that have systems that monitor the amount of fertilizer applied (e.g., My John Deere) Alternatively, information is collected via direct consultation with, and substantiated with a written attestation from, the grower or landowner of the sample unit. Any quantitative information (e.g., discrete or continuous numeric variables) on agricultural management practices is supported by one or more forms of documented evidence pertaining to the selected sample unit and relevant monitoring period (e.g., management logs, receipts or invoices, farm equipment specifications).
Purpose of Data	Calculation of baseline emissions
Comments	None

Data / Parameter	$MB_{g,bsl,i,t}$
Data unit	t dm
Description	Annual aboveground and belowground dry matter of N-fixing species g returned to soils in the baseline scenario for sample unit i in year t.
Source of data	Historical management records or attestation letters from each farmer. If this data is not available, regional values from literature will be used, following the guidance on BOX 1 of VM0042 v. 2.0
Value applied	Specific for each farmer
Justification of choice of data or description of measurement	Information is collected via direct consultation with, and substantiated with a written attestation from, the grower or landowner of the sample unit. Any quantitative information (e.g., discrete or continuous numeric variables) on agricultural management practices is supported by one or more forms of documented evidence pertaining to the selected sample unit and relevant

	monitoring period (e.g., management logs, receipts or invoices, farm equipment specifications). In case no historical record is available and no signed attestation letter can be used, regional (sub-national) average values will be used, according to BOX 1. Information collected, attested or taken from literature sources at regional level refers to yield (fresh weight). In order to to obtain the above and belowground dry matter of N-fixing crop residues, the yield (fresh weight) is converted to yield (dry matter) using equation 11.7 and conversion factors from table 11.1a, both from the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4, Chapter 11. Then, this value is converted to the aboveground and belowground crop residue dry matter using equation 11.6 and table 11.1a from the IPCC Guideline mentioned above.

	Dry matter fraction of harvested product	Ratio of aboveground residue dry matter to harvested yield	Ratio of belowground root biomass to aboveground shoot biomass
Soybeans	0.91	2.1	0.19
Beans and pulses	0.91	2.1	0.19
Alfalfa	0.9	1.0	0.40
Grass-clover mixture	0.90	0.3	0.80
Generic value for crops not indicated above	0.85	1.0	0.22

Purpose of Data	Calculation of baseline emissions
Comments	None

Data / Parameter	$P_{bsl,\mathrm{p}}$
Data unit	Productivity (e.g., kg) per hectare
Description	Average productivity for product p during the historical look-back period
Source of data	Average fresh yield weigh provided by farmer during enrollment
Value applied	Specific for each farmer. Below there are average yield (kg/ha) values per product at project level: Soybean 3,734

	Corn 12,177 Winter Wheat 3,264 Sorghum 4,888 Canola 4,296 Spring Wheat 3,868 Alfalfa 11,781 Timothy 5,519 Triticale 10,860 Barley 4,049 Cotton 304 Sugar Beets 48,673 Tall Fescue 20,183 Potato 73,796 Bluegrass 41,027 Buckwheat 2,756 Sweet Corn 74,490 Peas 19,204 Millet 1,821 Sorghum-Sudan 1,762 Oats 2,141 Lentils 1,600 Mustard 784 Safflower 4,209 Rye 2,197 Sunflower 2,297 Chickpeas 120,577 Asparagus 161,603
Justification of choice of data or description of measurement	Yield is measured using grower's locally available technologies such as commercial scales or storage volume measurements
Purpose of data	Determination of baseline productivity for future market leakage analysis
Comments	None

Data / Parameter	$RP_{bsl,p}$
Data unit	Productivity (e.g., kg) per hectare
Description	Average regional productivity for product p during the same years as the historical baseline period
Source of data	Regional productivity data will be obtained from the USDA National Agricultural Statistics Service database (USDA_NASS) for use in crop production yields for product p for the baseline period. The value applied will be defined during the baseline period years and the associated national data. Values will be reported for crop yield (kg/ha), USDA_NASS 2017 Census report, and supplemental findings. To determine the average regional productivity, annual average county yields will be used based on the instance location. Average state yield will be used when county data is not available. County level data is sourced by state from the USDA NASS website: https://www.nass.usda.gov/Publications/AgCensus/2017/ Full_Report/Volume_1,_Chapter_2_County_Level/
Value applied	Defined during leakage analysis

Justification of choice of data or description of measurement	Average yield for each crop represented in the project's initial instance baseline periods is sourced for the years included in the baseline periods from the USDA National Agricultural Statistics Service database. This represents a consistent collection and reporting approach across the project area. To determine the average regional productivity, annual average county yields will be used based on the instance location. Average state yield will be used when county data is not available.
Purpose of data	Determination of baseline productivity ratio for future market leakage analysis
Comments	None

Data / Parameter	A
Data unit	Unit area, hectares
Description	Project area
Source of data	Measured in project area using shapefiles of enrolled field (project instance) boundaries.
Value applied	95,184 hectares (235,204 acres)
Justification of choice of data or description of measurement	See above. Calculation based on the project's records - based on the values specified in contracts with farmers (from SalesForce). *Cross-check with GIS/remote sensing data.* Delineation of the project area will be also conducted using GIS data (shapefiles) All shapefiles will be transformed to the same coordinate reference system and projection and reviewed by Agoro to ensure only eligible hectares are included. Non-eligible areas including trees, ponds, ditch infrastructure, and barns or other buildings were excluded.
Purpose of data	Calculation of baseline and project emissions
Comments	None

Data / Parameter	$Pop_{bsl,l,i,t,P}$
Data unit	Head
Description	Population of grazing livestock of type l in the baseline scenario in sample unit i *for productivity system P* in year t
Source of data	Determined in sampled unit i from rancher provided management practice information on livestock activities
Value of data	According to Box 1 of the applied methodology
Justification of choice of data or description of measurement methods and procedures applied	Rancher attestation and/or farm management records (e.g. vet/ranch records) is sourced according to Box 1 in VM0042. Livestock population size is determined prior to verification.
Purpose of data	Calculation of baseline emissions
Calculation method	Where multiple classes of cattle are reported (i.e. cow/calf pairs, bulls, yearlings), all classes are converted to cow/calf equivalents using Natural

	Resource Conservation Service-published conversion factors. Total cattle herd size is then calculated as the sum of all cow/calf equivalents.
Comments	None

Data / Parameter	$W_{bsl,l,i,t,P}$
Data unit	kg animal mass/head
Description	Average weight in the baseline scenario of livestock type *l* for sample unit *i* in productivity system *P* in year t
Source of data	Determined in sampled unit i from rancher provided management practice information on livestock activities
Value applied	Dairy cattle: 650 kg/head Other cattle: 407 Sheep: 40 Swine: 77 Goats: 41 Horses: 377 Mules and Asses: 130
Justification of choice of data or description of measurement methods and procedures applied	Rancher attestation and/or farm management records will be sourced according to Box 1 in VM0042. Livestock type is determined prior to verification. In case this information is not available, the values in the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4, Chapter 10, Annex 10A.1, Table 10A.5 or other nationally relevant publications will be used.
Purpose of data	Calculation of baseline emissions
Comments	None

Data / Parameter	$MS_{bsl,l,i,t}$
Data unit	Fraction of N deposited
Description	Fraction of nitrogen excretion of livestock type l that is deposited in sample unit i in year t in the baseline scenario
Source of data	Number of grazing days according to information provided by each rancher during enrollment.
Value applied	Calculated value or 1
Justification of choice of data or description of measurement methods and procedures applied	The fraction of nitrogen deposited on the project area is determined based on the amount of time spent grazing on the project area during year t for each livestock type. The number of grazing days in the baseline period is provided by each rancher during enrolment, if relevant to their operation. In the absence of data available according to Box 1 of the methodology (or to conservatively reduce the effort of project development), a value of 1 may be applied with no additional support. This would conservatively

	assume that the livestock deposited 100% of their excreted N on the project area for the entirety of year t.
Purpose of data	Calculation of baseline emissions
Comments	None

5.2 Data and Parameters Monitored

Data / Parameter	$M_{n,dl,SOC}$
Data unit	kg/ha
Description	SOC mass in soil sample n in depth layer dl
Source of data	Measured after soil sampling in the project area
Description of measurement methods and procedures to be applied	See Section 8.2.1 of the VM0042 methodology
Frequency of monitoring/recording	At least every five years, or prior to each verification event if less than five years
Value applied	N/A, modeled values
Monitoring equipment	N/A, modeled values
QA/QC procedures to be applied	Soil mass must not include particles greater than 2 mm in diameter (i.e., gravel/stones) nor plant material.
Purpose of data	Calculation of baseline and project emissions.
Calculation method	Wendt and Hauser (2013) and von Haden et al. (2020) provide spreadsheets or R scripts to standardize and facilitate calculations of SOC stock calculations with multiple soil depth increments
Comments	None

Data / Parameter	$M_{n,dl,sample}$
Data unit	g
Description	Soil mass of sample n in depth layer dl
Source of data	Measured after soil sampling in the project area
Description of measurement methods and procedures to be applied	See Section 8.2.1 of the VM0042 methodology
Frequency of monitoring/recording	At least every five years, or prior to each verification event if less than five years
Value applied	N/A, modeled values
Monitoring equipment	N/A, modeled values
QA/QC procedures to be applied	Soil mass must not include particles greater than 2 mm in diameter (i.e., gravel/stones) nor plant material.
Purpose of data	Calculation of baseline and project emissions.
Calculation method	Mass of gravel/stones and plant material must be subtracted from the sample mass to obtain soil mass.
Comments	None

Data / Parameter	D
Data unit	mm
Description	Inside diameter of probe or auger
Source of data	Measured as part of project monitoring
Description of measurement methods and procedures to be applied	Information from product specifications of probe or auger

Frequency of monitoring/recording	At least every five years, or prior to each verification event if less than five years
Value applied	38.1 mm
Monitoring equipment	N/A
QA/QC procedures to be applied	See Section 8.2.1 of the applied methodology
Purpose of data	Calculation of baseline and project emissions.
Calculation method	Not applicable
Comments	None

Data / Parameter	N
Data unit	Unitless
Description	Number of cores sampled
Source of data	Measured in the project area
Description of measurement methods and procedures to be applied	The number of samples taken is determined as part of the development of a sampling strategy
Frequency of monitoring/recording	At least every five years, or prior to each verification event if less than five years
Value applied	11,722
Monitoring equipment	N/A, modeled values
QA/QC procedures to be applied	See Section 8.2.1 of the applied methodology
Purpose of data	Calculation of baseline and project emissions.
Calculation method	Not applicable

Comments	None

Data / Parameter	$OC_{n,dl}$
Data unit	g/kg
Description	Organic carbon content in sample n from depth layer dl
Source of data	Measured in the project area
Description of measurement methods and procedures to be applied	Dry combustion techniques is used for the measuring SOC content. Emerging technologies (INS, LIBS, MIR and Vis-NIR) with known uncertainty may be applied to measure SOC concentration following the criteria in Appendix 4 of the applied methodology,
Frequency of monitoring/recording	At least every five years, or prior to each verification event if less than five years
Value applied	N/A, modeled values
Monitoring equipment	N/A, modeled values
QA/QC procedures to be applied	See Section 8.2.1 of the applied methodology
Purpose of data	Calculation of baseline and project emissions.
Calculation method	Not applicable
Comments	None

Data / Parameter	BD_{corr}
Data unit	g/cm^3
Description	Corrected bulk density of the fine soil fraction after sieving thru 1.2 mm sieve (after subtracting the mass proportion of the coarse fragments)
Source of data	According to VMD0053 for bulk density data requirements for model calibration and validation
Description of measurement methods and procedures to be applied	See “Source of data”

Frequency of monitoring/recording	At least every five years, or prior to each verification event if less than five years
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	According to Sections 8.2.1.3 and 8.2.1.5 of the applied methodology for general sampling and measurement guidance relevant for bulk density data
Purpose of data	Determination of baseline scenario, calculation of baseline and project emissions
Calculation method	Fine soil fraction mass minus mass proportion of the coarse fragments
Comments	None

Data / Parameter	d
Data unit	cm
Description	Soil depth
Source of data	According to VMD0053 for 3 for requirements on calibration datasets
Description of measurement methods and procedures to be applied	Soil depth for each depth increment will be captured as part of data collection following requirements in VMD0053
Frequency of monitoring/recording	At least every five years, or prior to each verification event if less than five years
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	According to VMD0053 requirements on calibration datasets
Purpose of data	Determination of baseline scenario, calculation of baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	f(SOCbsl,i,t)
Data unit	t CO2e/ha
Description	Modeled SOC stocks in the baseline scenario for sample unit i at time t, calculated by modeling SOC stock changes over the course of the preceding year
Source of data	Modeled in the project area using DayCent model
Description of measurement methods and procedures to be applied	modeled soil organic carbon stocks in the baseline scenario are determined according to the equation: $SOC\_soil_{bsl,i,t} = f_{SOC}(Val\ A_{bsl,i,t}, Val\ B_{bsl,i,t}, \dots)$ SOC_soilbsl,i,t: modeled soil organic carbon stocks pool in the baseline scenario for sample unit i at time t (t CO2 e/ha) fSOC: Model predicting carbon dioxide emissions from the soil organic carbon pool (t CO2 e/ha). Vall$Absl,i$,t: Value of model input variable A in the baseline scenario for sample unit i at time t (units unspecified). VallBbsl,i,t: Value of model input variable B in the baseline scenario for sample unit i at time t (units unspecified). Model input variables will be sourced according to Box 1 of applied methodology.
Frequency of monitoring/recording	At least every five years, or prior to each verification event if less than five years
Value applied	N/A, can not be identified ex-ante, will be defined during the monitoring stage
Monitoring equipment	Modelling will be done with the DAYCENT model
QA/QC procedures to be applied	Agoro Carbon will follow the requirements of Box 1 regarding appropriate sources of qualitative and quantitative data on grower agricultural management practices implemented each year, used to establish model input variables.
Purpose of data	Calculation of baseline emissions.
Calculation method	Not applicable
Comments	The SOC stocks at time t = 0 are calculated based on directly measured SOC content and bulk density at t = 0 or (back-) modeled to t = 0 from measurements within ±5 years of t = 0.

Data / Parameter	*i*
Data unit	dimensionless

Description	Sample unit; defined area that is selected for measurement and monitoring, stratum.
Source of data	Determined in project area based on biophysical and soil characteristics of project instance locations, historical management activities, and planned project activities
Description of measurement methods and procedures to be applied	The sample unit is determined prior to verification.
Frequency of monitoring/recording	Monitoring must be conducted at least every five years, or prior to each verification even if less than five years
Value applied	N/A
Monitoring equipment	N/A, not monitored using equipment
QA/QC procedures to be applied	Delineation of the sample unit will use a combination of GIS coverages, remote imagery, and other appropriate data. All imagery and GIS datasets used will be appropriately georegistered.
Purpose of data	Calculation of baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	A_i
Data unit	Hectares
Description	Area of sample unit i
Source of data	Measurement of each sample unit within the project area
Description of measurement methods and procedures to be applied	The sample unit area is measured prior to verification
Frequency of monitoring/recording	At least every five years, or prior to each verification event if less than five years
Value applied	N/A, as this value will change over time since this is a grouped project

Monitoring equipment	N/A
QA/QC procedures to be applied	Delineation of the sample unit area may use a combination of GIS coverages, ground survey data, remote imagery (satellite or aerial photographs), or other appropriate data. Any imagery or GIS datasets used will be geo-registered referencing corner points, clear landmarks or other intersection points.
Purpose of data	Calculation of baseline and project emissions
Calculation method	Not applicable
Comments	None

Data / Parameter	$EF_{Ndirect}$
Data unit	t N_2O-N/t N applied
Description	Emission factor for direct nitrous oxide emissions from N additions from synthetic fertilizers, organic amendments and crop residues
Source of data	2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 11 Table 11.1
Description of measurement methods and procedures to be applied	None, default IPCC value will be used. If the IPCC value will change in the future, the default value will be updated accordingly.
Frequency of monitoring/recording	At least every five years, or prior to each verification event if less than five years
Value applied	0.01
Monitoring equipment	None
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of baseline and project emissions
Calculation method	N/A
Comments	Emission factor applicable to N additions from mineral fertilizers, organic amendments and crop residues, and N mineralized from mineral soil as result of loss of soil carbon

Data / Parameter	NC_{SF}
Data unit	t N/t fertilizer
Description	N content of synthetic fertilizer type SF
Source of data	Growers data / Manufacturer specification on N content.
Description of measurement methods and procedures to be applied	N content is determined following fertilizer manufacturer's specifications.
Frequency of monitoring/recording	At least every five years, or prior to each verification event if less than five years
Value applied	N/A, specific for each type of synthetic fertilizer
Monitoring equipment	None
QA/QC procedures to be applied	None
Purpose of data	Calculation of baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	SF
Data unit	Dimensionless
Description	Type of synthetic N fertilizer
Source of data	Determined in sample unit i
Description of measurement methods and procedures to be applied	According to Box 1 of the methodology.
Frequency of monitoring/recording	At least every five years, or prior to each verification event if less than five years

Value applied	N/A, specific for each type of synthetic fertilizer
Monitoring equipment	None
QA/QC procedures to be applied	Guidance provided in IPCC (2003) Section 5.5 or IPCC (2000) Chapter 8 will be followed.
Purpose of data	Calculation of baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	$M_{wp,SF,i,t}$
Data unit	t fertilizer
Description	Mass of N-containing synthetic fertilizer type SF applied in the project for sample unit i in year t
Source of data	Management records from project area
Description of measurement methods and procedures to be applied	Information will be monitored via direct consultation with, and substantiated with a written attestation from, the farmer or landowner of the sample unit. Any quantitative information (e.g., discrete or continuous numeric variables) on ALM practices must be supported by one or more forms of documented evidence pertaining to the selected sample unit and relevant monitoring period (e.g., management logs, receipts or invoices, farm equipment specifications).
Frequency of monitoring/recording	At least every five years, or prior to each verification event if less than five years
Value applied	N/A, specific for each sample unit
Monitoring equipment	None
QA/QC procedures to be applied	Guidance provided in IPCC (2003) Section 5.5 or IPCC (2000) Chapter 8 will be applied
Purpose of data	Calculation of project emissions
Calculation method	N/A
Comments	None

Data / Parameter	NC_{OF}
Data unit	t N/t fertilizer
Description	N content of organic fertilizer type OF
Source of data	Peer-reviewed published data may be used. For example, default manure N contents may be selected from Edmonds et al. (2003) cited in U.S. Environmental Protection Agency. (2011). Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2009. EPA 430- R-11-005. Washington, D.C. or other regionally appropriate sources such as the European Environment Agency.
Description of measurement methods and procedures to be applied	See "Source of data"
Frequency of monitoring/recording	At least every five years, or prior to each verification event if less than five years
Value applied	Specific for each grower
Monitoring equipment	N/A
QA/QC procedures to be applied	Guidance provided in IPCC (2003) Section 5.5 or IPCC (2000) Chapter 8 will be applied.
Purpose of data	Calculation of baseline emissions
Calculation method	N/A
Comments	None

Data / Parameter	OF
Data unit	Dimensionless
Description	Type of organic N fertilizer
Source of data	Determined in sample unit i from grower management practice information provided on fertilizer use

Description of measurement methods and procedures to be applied	Grower attestation and/or farm management records will be sourced according to Box 1 in VM0042. Organic fertilizer type is determined prior to verification.
Frequency of monitoring/recording	Monitoring must be conducted at least every five years, or prior to each verification event if less than five years.
Value applied	N/A, can not be identified ex-ante, will be defined during the monitoring stage
Monitoring equipment	N/A
QA/QC procedures to be applied	Agoro will follow the requirements of Box 1 regarding appropriate sources of qualitative and quantitative data on grower agricultural management practices implemented each year. Guidance provided in IPCC (2003) Section 5.5 or IPCC (2000) Chapter 8 will be applied
Purpose of data	Calculation of baseline and project emissions
Calculation method	Not applicable
Comments	None

Data / Parameter	$M_{wp,OF,i,t}$
Data unit	t fertilizer
Description	Mass of N containing organic fertilizer applied in the project for sample unit i in year t
Source of data	Management records from project area
Description of measurement methods and procedures to be applied	Data is recorded by farmers in the farms data software, which calculates the amount of N applied based on the type of fertilizers applied and manufacture specifications regarding the N content in the type of fertilizer applied. Alternatively, information will be monitored via direct consultation with, and substantiated with a written attestation from, the grower or landowner of the sample unit. Any quantitative information (e.g., discrete or continuous numeric variables) on agricultural management practices will be supported by one or more forms of documented evidence pertaining to the selected sample unit and relevant monitoring period (e.g., management logs, receipts or invoices, farm equipment specifications).

Frequency of monitoring/recording	Monitoring will be conducted at least every five years, or prior to each verification event if less than five years
Value applied	N/A, can not be identified ex-ante, will be defined during the monitoring stage
Monitoring equipment	None
QA/QC procedures to be applied	Guidance provided in IPCC (2003) Section 5.5 or IPCC (2000) Chapter 8 will be applied
Purpose of data	Calculation of project emissions
Calculation method	N/A
Comments	None

Data / Parameter	$Frac_{GASF}$
Data unit	kg N volatilized/kg N applied
Description	Fraction of all synthetic N added to soils that volatilizes as NH3 and Nox.
Source of data	2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 11, Table 11.3, Volume 4 in IPCC (2019) will be applied
Description of measurement methods and procedures to be applied	N/A, default value
Frequency of monitoring/recording	Source of data for emission factor will be monitored every five years and will be updated when more accurate data applicable to the project
	conditions become available following the guidance in Section 8.3 under Quantification Approach 3 of the applied methodology.
Value applied	Default: 0.11 Urea: 0.15 Ammonium-based: 0.08 Nitrate-based: 0.01 Ammonium-nitrate-based: 0.05
Monitoring equipment	N/A
QA/QC procedures to be applied	Guidance provided in IPCC, 2003 Section 5.5 or IPCC, 2000 Chapter 8 will be applied.

Purpose of Data	Calculation of baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	$Frac_{GASM}$
Data unit	kg N volatilized/kg N applied
Description	Fraction of all organic N added to soils and N in manure and urine deposited on soils that volatilizes as NH3 and NOx
Source of data	2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 11 Table 11.3 Volume 4 in IPCC (2019) according to meth will be applied
Description of measurement methods and procedures to be applied	N/A, default value
Frequency of monitoring/recording	Source of data for emission factor will be monitored every five years and will be updated when more accurate data applicable to the project conditions becomes available following the guidance in Section 8.3 under Quantification Approach 3 of the applied methodology.
Value applied	0.21
Monitoring equipment	N/A
QA/QC procedures to be applied	Guidance provided in IPCC, 2003 Section 5.5 or IPCC, 2000 Chapter 8 will be applied.
Purpose of Data	Calculation of baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	$Frac_{LEACH}$
Data unit	kg N/kg N additions

Description	Fraction of N added (synthetic or organic) to soils and N in manure and urine deposited on soils that is lost through leaching and runoff, in regions where leaching and runoff occurs
Source of data	2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 11 Table 11.3
Description of measurement methods and procedures to be applied	N/A, default value.
Frequency of monitoring/recording	Source of data for emission factor will be monitored every five years and will be updated when more accurate data applicable to the project conditions becomes available following the guidance in Section 8.3 under Quantification Approach 3 of the applied methodology.
Value applied	For wet climates or in dry climate regions where irrigation (other than drip irrigation) is used, a value of 0.24 will be applied. For all other dry climate regions, a value of zero will be applied.
Monitoring equipment	N/A
QA/QC procedures to be applied	Guidance provided in IPCC, 2003 Section 5.5 or IPCC, 2000 Chapter 8 will be applied.
Purpose of Data	Calculation of baseline and project emissions
Calculation method	N/A
Comments	Wet climates occur in temperate and boreal zones where the ratio of annual precipitation: potential evapotranspiration > 1. Dry climates occur in temperate and boreal zones where the ratio of annual precipitation: potential evapotranspiration < 1.

Data / Parameter	EF_{Nleach}
Data unit	t N_2O-N / t N leached and runoff
Description	Emission factor for nitrous oxide emissions from leaching and runoff
Source of data	2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 11 Table 11.3
Description of measurement methods and procedures to be applied	See “Source of data”

Frequency of monitoring/recording	Source of data for emission factor will be monitored every five years and will be updated when more accurate data applicable to the project conditions becomes available following the guidance in Section 8.3 under Quantification Approach 3 of the applied methodology.
Value applied	0.011
Monitoring equipment	N/A
QA/QC procedures to be applied	Guidance provided in IPCC (2003) Section 5.5 or IPCC (2000) Chapter 8 will be applied.
Purpose of Data	Calculation of baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	$MB_{g,wp,i,t}$
Data unit	t dm
Description	Annual aboveground and belowground dry matter of N-fixing species g returned to soils for sample unit i in year t
Source of data	Historical management records or attestation letters from each farmer. If this data is not available, regional values from literature will be used, following the guidance on BOX 1 of VM0042 v. 2.0
Description of measurement methods and procedures to be applied	Information is collected via direct consultation with, and substantiated with a written attestation from, the grower or landowner of the sample unit. Any quantitative information (e.g., discrete or continuous numeric variables) on agricultural management practices is supported by one or more forms of documented evidence pertaining to the selected sample unit and relevant monitoring period (e.g., management logs, receipts or invoices, farm equipment specifications). In case no historical record is available and no signed attestation letter can be used, regional (sub-national) average values will be used, according to BOX 1. Information collected, attested or taken from literature sources at regional level refers to yield (fresh weight). In order to to obtain the above and belowground dry matter of N-fixing crop residues, the yield (fresh weight) is converted to yield (dry matter) using equation 11.7 and conversion factors from table 11.1a, both from the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories

	Volume 4, Chapter 11. Then, this value is converted to the aboveground and belowground crop residue dry matter using equation 11.6 and table 11.1a from the IPCC Guideline mentioned above.

	Dry matter fraction of harvested product	Ratio of aboveground residue dry matter to harvested yield	Ratio of belowground root biomass to aboveground shoot biomass
Soybeans	0.91	2.1	0.19
Beans and pulses	0.91	2.1	0.19
Alfalfa	0.9	1.0	0.40
Grass-clover mixture	0.90	0.3	0.80
Generic value for crops not indicated above	0.85	1.0	0.22

Frequency of monitoring/recording	Monitoring will be conducted at least every five years, or prior to each verification event where verification occurs more frequently.
Value applied	This value cannot be estimated in advance as it will depend on each individual grower's agricultural operations in a given year.
Monitoring equipment	N/A

QA/QC procedures to be applied	Guidance provided in IPCC (2003) Section 5.5 or IPCC (2000) Chapter 8 will be applied.
Purpose of data	Calculation of project emissions
Calculation method	Not applicable
Comments	None

Data / Parameter	$N_{content,g}$
Data unit	t N/t dm
Description	Fraction of N in dry matter for N-fixing species g
Source of data	2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 11 Table 11a
Description of measurement methods and procedures to be applied	N/A
Frequency of monitoring/recording	Source of data for emission factor will be monitored every five years and will be updated when more accurate data applicable to the project conditions becomes available following the guidance in Section 8.3 under Quantification Approach 3 of the applied methodology.
Value applied	The fraction of N in dry matter is determined based on the N-fixing species type. Soybeans: 0.008 (aboveground); 0.008 (belowground) Alfalfa: 0.027 (aboveground); 0.019 (belowground) Beans and pulses: 0.008 (aboveground); 0.008 (belowground) Grass-clover mixtures: 0.025 (aboveground); 0.016 (belowground) Generic values for crops not specified in Table 11.1: 0.008 (aboveground); 0.009 (belowground)
Monitoring equipment	N/A
QA/QC procedures to be applied	Guidance provided in IPCC (2003) Section 5.5 or IPCC (2000) Chapter 8 will be applied.
Purpose of Data	Calculation of baseline and project emissions
Calculation method	N/A

Comments	None

Data / Parameter	g
Data unit	Dimensionless
Description	Type of N-fixing species
Source of data	Determined in sample unit i from grower management practice information on cropping activities
Description of measurement methods and procedures to be applied	Grower attestation and/or farm management records will be sourced according to Box 1 in VM0042. N-fixing species type is determined prior to verification.
Frequency of monitoring/recording	At least every five years, or prior to each verification event if less than five years.
Value applied	Various N-fixing species such as soybean, clover, vetch, or other leguminous cover crops.
Monitoring equipment	N/A
QA/QC procedures to be applied	Agoro will follow the requirements of Box 1 regarding appropriate sources of qualitative and quantitative data on grower agricultural management practices implemented each year. Guidance provided in IPCC (2003) Section 5.5 or IPCC (2000) Chapter 8 will be applied.
Purpose of data	Calculation of baseline and project emissions.
Calculation method	Not applicable
Comments	None

Data / Parameter	EF_{Nvolat}
Data unit	t N_2O-N /(t NH_3-N + NOx-N volatilized)
Description	Emission factor for nitrous oxide emissions from atmospheric deposition of N on soils and water surfaces
Source of data	2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 11 Table 11.3
Description of measurement methods and procedures to be applied	See “Source of data”

Frequency of monitoring/recording	Source of data for emission factor will be monitored every five years and will be updated when more accurate data applicable to the project conditions becomes available following the guidance in Section 8.3 under Quantification Approach 3 of the applied methodology.
Value applied	0.01
Monitoring equipment	N/A
QA/QC procedures to be applied	Guidance provided in IPCC (2003) Section 5.5 or IPCC (2000) Chapter 8 will be followed.
Purpose of Data	Calculation of baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	$M\_OA_{wp,l,t}$
Data unit	tonnes
Description	Mass of organic amendment applied as fertilizer on the project area in year t
Source of data	Management records from project area
Description of measurement methods and procedures to be applied	For manure application, data will be disaggregated for each livestock type l
Frequency of monitoring/recording	Monitoring will be conducted at least every five years, or prior to each verification event if verification will occur more frequently.
Value applied	N/A, farmer specific data
Monitoring equipment	N/A
QA/QC procedures to be applied	Guidance provided in IPCC (2003) Section 5.5 or IPCC (2000) Chapter 8 will be followed.
Purpose of Data	Calculation of leakage from application of new organic amendments from outside of the project area
Calculation method	N/A
Comments	None

Data / Parameter	$CC_{wp,l,t}$
Data unit	t C/t manure
Description	Carbon content of manure from livestock type l applied as fertilizer on the project area in year t
Source of data	Table 5.5c of IPPC Guidelines vol 4 Chapter 5 (2019)
Description of measurement methods and procedures to be applied	Record of carbon content of manure
Frequency of monitoring/recording	Monitoring will be conducted at least every five years, or prior to each verification event if verification will occur more frequently.
Value applied	Liquid swine manure: 0.451 t C / t manure Poultry litter: 0.51 t C / t litter Dairy Cattle 0.464 t C / t litter Beef Cattle 0.437 t C / t litter Horses/Mules/Asses 0.26 t C / t litter Sheep 0.363 t C / t litter
Monitoring equipment	N/A, not monitored using equipment
QA/QC procedures to be applied	Values sourced from peer-reviewed literature will be verified and, if needed, updated based on the best and most recently available science prior to each verification event. Guidance provided in IPCC (2003) Section 5.5 or IPCC (2000) Chapter 8 will be followed.
Purpose of Data	Calculation of leakage from application of new organic amendments from outside of the project area
Calculation method	Carbon content of manure residues is calculated by multiplying the amount of manure applied by the nitrogen content per unit of manure and then multiplying by the C:N ratio of that manure type, as determined from Table 5.5C in the 2019 Refinement IPCC
Comments	None

Data / Parameter	$P_{wp,p}$
Data unit	Output (e.g., kg or bushel) per hectare
Description	Average productivity for product p during the project period
Source of data	Farm productivity (e.g., yield) records

Description of measurement methods and procedures to be applied	Yield will be measured using grower's locally available technologies such as e.g., mobile weighing devices, commercial scales, storage volume measurements, fixed scales, weigh scale tickets.
Frequency of monitoring/recording	Yields must be measured each growing season. The average productivity for a specific crop will be calculated for the project period between leakage calculation events at each leakage calculation event, which occur every 10 years.
Value applied	Value cannot be estimated in advance as yields will vary by grower depending on practices, weather, etc. year over year.
Monitoring equipment	N/A, not monitored using equipment
QA/QC procedures to be applied	Guidance provided in IPCC (2003) Section 5.5 or IPCC (2000) Chapter 8 will be followed.
Purpose of data	Determination of project productivity for market leakage analysis
Calculation method	Not applicable
Comments	None

Data / Parameter	p
Data unit	Categorical variable
Description	Crop product type
Source of data	Data sourcing is conducted according to Box 1 in VM0042 based e.g. on the growers data, planting/harvest maps 2) USDA CroplandCROS crop type layer https://croplandcros.scinet.usda.gov/ - for the year prior to the actual 3) satellite imagery, invoices 4) selfattestation from the farmers
Description of measurement methods and procedures to be applied	N/A
Frequency of monitoring/recording	Crop grown must be recorded every growing season. Market leakage analysis will be conducted every 10 years.

Value applied	Value cannot be estimated in advance as crop grown may vary from grower to grower and year to year depending on weather, market forces, and other agricultural management considerations. Most likely, crop products grown will continue to include corn, soy, and wheat.
Monitoring equipment	N/A, not monitored using equipment
QA/QC procedures to be applied	Agoro Carbon will follow the requirements of Box 1 of the applied methodology.
Purpose of data	Identification of crop product for market leakage analysis, as well as for calculation of baseline and project emissions
Calculation method	N/A, categorical variable
Comments	None

Data / Parameter	$RP_{wp,\mathrm{p}}$
Data unit	Output (e.g., kg) per hectare
Description	Average regional productivity for product p during the same years as the project period.
Source of data	Regional productivity data from government, industry, published, academic or international organization sources. E.g. USDA National Agricultural Statistics Service Quick Stats database, USDA National Agricultural Statistics Service Agricultural Census or Survey data.
Description of measurement methods and procedures to be applied	Average yield for each crop represented in the project's initial instance project periods will be sourced for the years included in the baseline periods from the USDA National Agricultural Statistics Service Quick Stats database. https://quickstats.nass.usda.gov/. To determine the average regional productivity, annual average state yields will be averaged across all states and years included.
Frequency of monitoring/recording	Market leakage analysis will be conducted every 10 years.
Value applied	Not applicable, value cannot be estimated in advance.
Monitoring equipment	N/A, not monitored using equipment

QA/QC procedures to be applied	Guidance provided in IPCC (2003) Section 5.5 or IPCC (2000) Chapter 8 will be followed.
Purpose of data	Determination of project productivity ratio for market leakage analysis
Calculation method	N/A
Comments	None

Data / Parameter	$SOC_{bsl,i,t}$
Data unit	t CO_2e/ha
Description	Areal-average soil organic carbon stocks in the baseline scenario for sample unit i in year t
Source of data	modeled in the project area
Description of measurement methods and procedures to be applied	See $fSOC$bsl,i,t
Frequency of monitoring/recording	At least every five years, or prior to each verification event if less than five years
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	According to Section 8.2.1 and VMD0053
Purpose of data	Calculation of baseline emissions.
Calculation method	Not applicable
Comments	SOC stocks at time t = 0 are calculated based on directly measured SOC content and bulk density at t = 0 or (back-) modeled to t = 0 from measurements collected within ±5 years of t = 0. This initially measured SOC is the same in both the baseline and project scenarios at the outset of the project (i.e., SOCwp,i,0 = SOCbsl,i,0) in Quantification Approach 1.

Data / Parameter	$SOC_{bsl,i,t-1}$
Data unit	t CO_2e/ha
Description	Areal mean SOC stocks in the baseline scenario for sample unit i in year t − 1@
Source of data	modeled in the project area
Description of measurement methods and procedures to be applied	See parameter table for $SOC_{bsl,i,t}$
Frequency of monitoring/recording	At least every five years, or prior to each verification event if less than five years
Value applied	N/A, can not be identified ex-ante, will be defined during the monitoring stage
Monitoring equipment	N/A, Modelling will be done with the Daycent model
QA/QC procedures to be applied	Agoro Carbon will follow the requirements of Box 1 and VMD0053.
Purpose of data	Calculation of baseline emissions.
Calculation method	Not applicable
Comments	None

Data / Parameter	$SOC_{wp,i,t}$
Data unit	t CO_2e/ha
Description	Areal mean SOC stocks in the project scenario for sample unit i in year t
Source of data	modeled in the project area

<table>
<tr>
<td>Description of measurement methods and procedures to be applied</td>
<td>
Modeled SOC stocks in the project scenario are determined following the guidance in VMD0053 and according to the following equation:
$$SOC_{wp,i,t} = f_{soc}(Var\ A_{wp,i,t}, Var\ B_{wp,i,t}, \ldots)$$
Where
<table>
<tr><td>$f(SOC_{wp,i,t})$</td><td>Modeled carbon dioxide emissions from SOC pool in the project for sample unit i at time t (t CO_2e/ha)</td></tr>
<tr><td>f_{soc}</td><td>Model predicting carbon dioxide emissions from the soil organic carbon pool (t CO_2 e/acre)</td></tr>
<tr><td>$Val\ A_{wp,i,t}$</td><td>Value of model input variable A in the project scenario for sample unit i at time t (units unspecified)</td></tr>
<tr><td>$Val\ B_{wp,i,t}$</td><td>Value of model input variable B in the project scenario for sample unit i at time t (units unspecified)</td></tr>
</table>
Model input variables will be sourced according to Box 1 in VM0042.
All organic material (e.g., living plants, crop residue) will be cleared from the soil surface prior to soil sampling. Soil will be sampled to a minimum depth of 30 cm.
Soil organic carbon stocks will be estimated from measurements of both soil organic carbon content and bulk density taken at the same time, at the project start and re-measured every 5 years or less.
Geographic locations of intended sampling points will be established prior to sampling. The location of both the intended sampling point and the actual sampling point will be recorded.
If multiple cores are composited to create a single sample, these cores must all be from the same depth and be fully homogenized prior to subsampling.
Soils will be shipped within 5 days of collection and should be kept cool until shipping.
</td>
</tr>
<tr><td>Frequency of monitoring/recording</td><td>At least every five years, or prior to each verification event if less than five years</td></tr>
<tr><td>Value applied</td><td>N/A - variable with time</td></tr>
<tr><td>Monitoring equipment</td><td>Modelling will be done with the DAYCENT model</td></tr>
</table>

QA/QC procedures to be applied	Agoro will follow the requirements of Section 8.2.1 of the applied methodology and for Quantification Approach 1, VMD0053. Standard QA/QC procedures for soil inventory including field data collection and data management will be applied. Soils will be cleared of all organic matter at the surface prior to sampling. Samples will be collected to a minimum depth of 30 cm, ideally as contiguous cores divided into shorter increments. Bulk density measurements will not include the mass of large particles, stones, or plant material. Samples will be shipped to the lab within five days of collection. Dry combustion will be used to measure SOC.
Purpose of data	Calculation of project emissions.
Calculation method	Not applicable
Comments	The soil organic carbon stocks at time t=0 are directly measured at t=0 or (back-) modeled to t =0 from measurements collected within +/-5 years of t=0, or determined for t=0 via emerging technologies (e.g., remote sensing) with known uncertainty, and must be used in both the baseline and with- project scenario for the length of the project. Soil organic carbon stocks in the project scenario for sample unit i must be reported every 5 years or less.

Data / Parameter	$SOC_{wp,i,t-1}$
Data unit	t CO_2e/ha
Description	Areal mean soil organic carbon stocks in the project scenario for sample unit i in year t-1
Source of data	modeled in the project area
Description of measurement methods and procedures to be applied	See $SOC_{wp,i,t}$ above.
Frequency of monitoring/recording	At least every five years, or prior to each verification event if less than five years
Value applied	N/A - variable with time
Monitoring equipment	N/A
QA/QC procedures to be applied	See $SOC_{wp,i,t}$ above.

Purpose of data	Calculation of project emissions.
Calculation method	Not applicable
Comments	None

Data / Parameter	•
Data unit	Dimensionless
Description	Gas or pool
Source of data	Determined in sample unit i
Description of measurement methods and procedures to be applied	Not applicable
Frequency of monitoring/recording	At least every five years, or prior to each verification event if less than five years
Value applied	N/A, cannot be identified ex-ante, will be defined during the monitoring stage
Monitoring equipment	N/A
QA/QC procedures to be applied	Not applicable
Purpose of data	Calculation of baseline and project emissions
Calculation method	Not applicable
Comments	None

Data / Parameter	$\overline{\Delta}$ •,t and •$\overline{\text{t}}$
Data unit	t CO2e/ha
Description	Mean emission reductions from pool or source •, or stock of pool •, in year t
Source of data	Calculated from modeled and calculated values in the project area

Description of measurement methods and procedures to be applied	Not applicable
Frequency of monitoring/recording	At least every five years, or prior to each verification event if less than five years
Value applied	N/A, will be calculated
Monitoring equipment	N/A
QA/QC procedures to be applied	Comparison of project results with values from peer-reviewed literature under similar conditions.
Purpose of data	Calculation of emission reductions
Calculation method	The mean emission reductions from pool or source •, or stock of pool •, at time t are estimated using unbiased statistical approaches.
Comments	None

Data / Parameter	$Buffer_{,t}$
Data unit	tCO_{2e}
Description	Number of buffer credits to be contributed to the AFOLU pooled buffer account in year t
Source of data	The number of buffer credits to be contributed to the AFOLU pooled buffer account must be determined by applying valid version of the VCS AFOLU Non-Permanence Risk Tool.
Description of measurement methods and procedures to be applied	Not applicable
Frequency of monitoring/recording	Monitoring will be conducted at least every five years, or prior to each verification event if less than five years
Value applied	Buffer contribution is likely to be approximately 22%. Amount of tCO_2e contributed to the buffer pool cannot be determined in advance.
Monitoring equipment	N/A, not monitored using equipment

QA/QC procedures to be applied	The number of buffer credits to be contributed to the AFOLU pooled buffer account must be determined by applying the valid version of the VCS AFOLU Non-Permanence Risk Tool
Purpose of data	Calculation of credits to be allocated to AFOLU pooled buffer account
Calculation method	The number of buffer credits to be contributed to the AFOLU pooled buffer account must be determined by applying the valid version of the VCS AFOLU Non-Permanence Risk Tool
Comments	None

Data / Parameter	$EF_{ent,I,P}$
Data unit	kg CH_4 /(head*year)
Description	Enteric fermentation emission factor for livestock type I and productivity system P
Source of data	2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 10 Table 10.10 and Table 10.11.
Description of measurement methods and procedures to be applied	N/A, default value
Frequency of monitoring/recording	At least every five years, or prior to each verification event if less than five years
Value applied	Dairy Cattle: 138 Other cattle: 64 Sheep: 9 Swine: 1.5 Goats: 9 Horses: 18 Mules and asses: 10
Justification of choice of data or description of measurement methods and procedures applied	N/A, default IPCC values
Purpose of Data	Calculation of baseline and project emissions
Comments	None

Data / Parameter	$Pop_{wp,l,i,t}$

Data unit	Head
Description	Population of grazing livestock of type l in the project scenario in sample unit i for productivity system P in year t
Source of data	Determined in sampled unit i from rancher provided management practice information on livestock activities
Description of measurement methods and procedures to be applied	rancher attestation and/or farm management records will be sourced according to Box 1 in VM0042. Livestock population size is determined prior to verification
Frequency of monitoring/recording	Monitoring must be conducted at least every five years, or prior to each verification event if less than five years
Value applied	This value cannot be estimated in advance as it will depend on each individual rancher's incorporation of livestock, if any, into their agricultural operations in a given year
Monitoring equipment	N/A, not monitored using equipment
QA/QC procedures to be applied	Agoro Carbon will follow the requirements of Box 1 and the procedures in Appendix 6.7 regarding appropriate sources of qualitative and quantitative data on rancher agricultural management practices implemented each year. Guidance provided in IPCC (2003) Section 5.5 or IPCC (2000) Chapter 8 will be followed
Purpose of data	Calculation of project emissions
Calculation method	N/A
Comments	None

Data / Parameter	*l*
Data unit	dimensionless
Description	Type of livestock
Source of data	Determined in sample unit i from rancher management practice information on livestock activities.
Description of measurement methods and procedures to be applied	rancher attestation and/or farm management records (e.g. vet records/ranch records) will be sourced according to Box 1 in VM0042. Livestock type is determined prior to verification.
Frequency of monitoring/recording	Monitoring must be conducted at least every five years, or prior to each verification event if less than five years.
Value applied	N/A, as it cannot be estimated ex-ante, and will be determined during the monitoring stage.
Monitoring equipment	N/A

QA/QC procedures to be applied	Agoro Carbon will follow the requirements of Box 1 of the applied methodology regarding appropriate sources of qualitative and quantitative data on rancher agricultural management practices implemented each year.
Purpose of data	Calculation of baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	*P*
Data unit	Unitless
Description	Productivity system
Source of data	Determined at farm level. Subsection "Definitions of High and Low Productivity Systems," Section 10.2, Chapter 10, Volume 4 of IPCC (2019) will be consulted. Instructions specific for high/low productivity system classification for each livestock type in Tables 10.10, 10.11 and 10.14 from IPCC (2019) may also be consulted.
Description of measurement methods and procedures to be applied	When using emission factors from IPCC (2019), we differentiate between high- and low productivity systems for each livestock species to define value from Lookup Tables 10A.1 to 10A.9, 10.10, 10.11 and 10.14 in the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4, Chapter 10 report. Information will be monitored via direct consultation with, and substantiated with a written attestation from, the farmer or landowner of the sample unit according to Box 1 of the applied methodology.
Frequency of monitoring/recording	Will be conducted at least every five years, or prior to each verification event where verification occurs more frequently. Any changes to the productivity system will be documented in each monitoring report.
Value applied	Various values
Monitoring equipment	N/A
QA/QC procedures to be applied	See "Source of data" and Section 8.3 under Quantification Approach 3
Purpose of data	Calculation of baseline and project emissions
Calculation method	Following descriptions in IPCC (2019), basic population estimates will be applied (see "Source of data").
Comments	None

Data / Parameter	$AWMS_{l,i,t,P,S}$
Data unit	Dimensionless

Description	Fraction of total annual volatile solids for each livestock type I that is managed in manure management system S in the project area, for productivity system P
Source of data	Determined at farm level.
Description of measurement methods and procedures to be applied	As emissions from manure management systems are highly temperature dependent, the climate zone associated with the entire project area where manure is managed will be considered.
Frequency of monitoring/recording	Source of data for emission factor will be monitored every five years and will be updated when more accurate data applicable to the project conditions becomes available following the guidance in Section 8.3 under Quantification Approach 3 of the applied methodology.
Value applied	1
Monitoring equipment	N/A
QA/QC procedures to be applied	See “Source of data” and Section 8.3 under Quantification Approach 3.
Purpose of data	Calculation of baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	$EF_{CH4,md,I,P,S}$
Data unit	g CH_4 / kg volatile solids
Description	Emission factor for methane emissions from manure deposition for livestock type I in productivity system P and manure management system S
Source of data	2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 10 Table 10.14 and Table 10.15.
Description of measurement methods and procedures to be applied	See “Source of data”
Frequency of monitoring/recording	Source of data for emission factor will be monitored every five years and will be updated when more accurate data applicable to the project conditions becomes available following the guidance in Section 8.3 under Quantification Approach 3 of the applied methodology.
Value applied	0.6
Monitoring equipment	N/A
QA/QC procedures to be applied	Source of data is referenced as an acceptable source by the methodology. VM0042 states, “Excluding livestock types listed in Table 10.15 in Chapter 10 of the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4, a value

	of 0.6 is applied for all animals in both low and high productivity pasture, range, and paddock systems per Table 10.14 of the same chapter.”
Purpose of data	Calculation of baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	S
Data unit	Unitless
Description	Manure management system
Source of data	Determined at farm level according to the definitions provided in Table 10.18, Chapter 10, Volume 4 in IPCC (2019)
Description of measurement methods and procedures to be applied	According to the Section 8.3 under Quantification Approach 3 of applied methodology. When using methane and nitrous oxide emission factors from IPCC (2019), differentiation will take place between manure management systems to define value from Lookup Tables 10.14 and 10.17. The referenced table of IPCC (2019) provides Tier 1a emission factors, which consider different aeration and mixing regimes as well as other factors such as water content, thus influencing CH4 and N2O emissions differently.
Frequency of monitoring/recording	Source of data for emission factor will be monitored every five years and will be updated when more accurate data applicable to the project conditions becomes available following the guidance in Section 8.3 under Quantification Approach 3 of the applied methodology.
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	See “Source of data” and Section 8.3 under Quantification Approach 3.
Purpose of data	Calculation of baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	$VS_{rate,l}$
Data unit	kg volatile solids / (1000 kg animal mass * day)
Description	Default volatile solids excretion rate for livestock type l and productivity system P

Source of data	2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 10 Table 10.13a.
Description of measurement methods and procedures to be applied	N/A
Frequency of monitoring/recording	Source of data for emission factor will be monitored every five years and will be updated when more accurate data applicable to the project conditions becomes available following the guidance in Section 8.3 under Quantification Approach 3 of the applied methodology
Value applied	Dairy cattle: 9.3 Other cattle: 7.6 Sheep: 8.2 Swine: 3.3 Goats: 9 Horses: 5.65 Mules and asses: 7.2
Monitoring equipment	N/A
QA/QC procedures to be applied	Source of data is referenced as an acceptable source by the methodology
Purpose of data	Calculation of baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	$W_{wp,l,i,t}$
Data unit	kg animal mass/head
Description	Average weight in the project scenario of livestock type l for sample unit i in productivity system P in year t
Source of data	Determined in sampled unit i from rancher provided management practice information on livestock activities
Description of measurement methods and procedures to be applied	Rancher attestation and/or farm management records will be sourced according to Box 1 in VM0042. Livestock type is determined prior to verification. Average weight for the indicated livestock type will be determined from farmer provided management practice information on livestock activities. In case this information is not available, the values in the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4, Chapter 10, Annex 10A.1, Table 10A.5 or other nationally relevant publications will be used.
Frequency of monitoring/recording	Monitoring must be conducted at least every five years, or prior to each verification event if less than five years
Value applied	Dairy cattle: 650 kg/head Other cattle: 407 Sheep: 40 Swine: 77

	Goats: 41 Horses: 377 Mules and Asses: 130
Monitoring equipment	N/A
QA/QC procedures to be applied	Guidance provided in IPCC (2003) Section 5.5 or IPCC (2000) Chapter 8 will be followed.
Purpose of data	Calculation of project emissions
Calculation method	N/A
Comments	None

Data / Parameter	$EF_{N2O,md,l,S}$
Data unit	kg N_2O-N / kg N input
Description	Emission factor for nitrous oxide from manure and urine deposited on soils by livestock type l and manure management system S
Source of data	2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 11 Table 11.1 or based on Tier 1 and Tier 1a from Table 10.21, Chapter 10, Volume 4.
Description of measurement methods and procedures to be applied	See "Source of data"
Frequency of monitoring/recording	Source of data for emission factor will be monitored every five years and will be updated when more accurate data applicable to the project conditions becomes available following the guidance in Section 8.3 under Quantification Approach 3 of the applied methodology
Value applied	Cattle, poultry, and swine: 0.004 Sheep, goats, horses, mules, and asses: 0.003
Monitoring equipment	N/A
QA/QC procedures to be applied	Guidance provided in IPCC (2003) Section 5.5 or IPCC (2000) Chapter 8 will be applied
Purpose of data	Calculation of baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	$Nex_{l,P}$
Data unit	kg N deposited/(head x year)

Description	Annual average nitrogen excretion per head of livestock type l in productivity system P
Source of data	2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 10 Table 10.19.
Description of measurement methods and procedures to be applied	See "Source of data"
Frequency of monitoring/recording	Source of data for emission factor will be monitored every five years and will be updated when more accurate data applicable to the project conditions becomes available following the guidance in Section 8.3 under Quantification Approach 3 of the applied methodology
Value applied	Dairy cattle: 0.6 Other cattle: 0.4 Sheep: 0.35 Swine: 0.39 Goats: 0.46 Horses: 0.3 Mules and asses: 0.3
Monitoring equipment	N/A
QA/QC procedures to be applied	Guidance provided in IPCC (2003) Section 5.5 or IPCC (2000) Chapter 8 will be applied
Purpose of data	Calculation of baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	$MS_{wp,l,i,t}$
Data unit	Fraction of N deposited
Description	Fraction of nitrogen excretion of livestock type l that is deposited in sample unit i in year t in the baseline scenario
Source of data	Number of grazing days according to information provided by each rancher during enrollment.
Description of measurement methods and procedures to be applied	The fraction of nitrogen deposited on the project area is determined based on the amount of time spent grazing on the project area during year t for each livestock type. The number of grazing days in the baseline period is provided by each rancher during enrolment, if relevant to their operation. In the absence of data available according to Box 1 of the methodology (or to conservatively reduce the effort of project development), a value of 1 may be applied with no additional support. This would conservatively assume that the livestock deposited 100% of their excreted N on the project area for the entirety of year t.

Frequency of monitoring/recording	Source of data for emission factor will be monitored every five years and will be updated when more accurate data applicable to the project conditions becomes available following the guidance in Section 8.3 under Quantification Approach 3 of the applied methodology
Value applied	1 or lower, depending on evidence available
Monitoring equipment	N/A
QA/QC procedures to be applied	Guidance provided in IPCC (2003) Section 5.5 or IPCC (2000) Chapter 8 will be applied
Purpose of data	Calculation of project emissions
Calculation method	N/A
Comments	None

Data / Parameter	EFCO2,j
Data unit	t CO2e/liter
Description	Emission factor for fossil fuel j (gasoline or diesel) combusted
Source of data	Table 3.3.1 Chapter 3 Volume 2 in IPCC (2019)
Description of measurement methods and procedures to be applied	For gasoline EFCO2 = 0.002810 t CO2e per liter. For diesel EFCO2 = 0.002886 t CO2e per liter
Frequency of monitoring/recording	Source of data for emission factor must be monitored every five years and must be updated when more accurate data applicable to the project conditions becomes available following the guidance in Section 8.3 under Quantification Approach 3.
Value applied	For gasoline EFCO2 = 0.002810 t CO2e per liter. For diesel EFCO2 = 0.002886 t CO2e per liter
Monitoring equipment	N/A
QA/QC procedures to be applied	See “Source of data”
Purpose of data	De minimis source
Calculation method	N/A

Comments	None

Data / Parameter	FFCwp,j,i,t
Data unit	Liters
Description	Consumption of fossil fuel type j for sample unit i in year t in the project scenario
Source of data	Determined in sampling unit i from farmer provided management practice information, according to Box 1 of the VM0042 methodology .
Description of measurement methods and procedures to be applied	The agricultural operations that consume fossil fuel (e.g. planting) are recorded. The fossil fuel consumption associated with each of them is estimated by multiplying the field area by their average fossil fuel consumption factor. This calculation will be done for baseline and project scenarios to make sure this GHG source remains de minimis.
Frequency of monitoring/recording	At least every five years, or prior to each verification event if less than five years
Value applied	N/A, specific to each field and farm operation
Monitoring equipment	N/A, not monitored with an equipment
QA/QC procedures to be applied	Guidance provided in IPCC (2003) Section 5.5 or IPCC (2000) Chapter 8 must be applied.
Purpose of data	Calculation of de minimis emissions.
Calculation method	Fuel efficiency factors may be obtained from Chapter 3, Volume 2 of IPCC (2019) or other applicable source of information at national or regional levels.
Comments	None

<u>Parameters to be used for the Quantification Approach 1 (modelling) of GHG emissions</u>

Data / Parameter	BD_{corr}
Data unit	g/cm^3
Description	Corrected bulk density of the fine soil fraction after sieving thru 1.2 mm sieve (after subtracting the mass proportion of the coarse fragments)

Source of data	According to VMD0053 for bulk density data requirements for model calibration and validation
Description of measurement methods and procedures to be applied	See “Source of data”
Frequency of monitoring/recording	At least every five years, or prior to each verification event if less than five years
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Modeling baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	MDD
Data unit	t CO2e/ha
Description	Minimum detectable difference in SOC stocks between two points in time
Source of data	Estimation of the smallest difference in SOC stocks between two monitoring events that may be detected as statistically significant
Description of measurement methods and procedures to be applied	See Section 8.2.1 of the VM0042 methodology
Frequency of monitoring/recording	At least every five years, or prior to each verification event if less than five years
Value applied	N/A, modeled values
Monitoring equipment	N/A, modeled values

QA/QC procedures to be applied	See Section 8.2.1 and further guidance in FAO (2019)
Purpose of data	Development of sampling strategy for baseline setting and measurements for monitoring.
Calculation method	See Section 8.2.1 of the VM0042 methodology
Comments	Calculation of the number of samples required to detect a minimum difference is optional.

Data / Parameter	*S*
Data unit	Dimensionless
Description	Standard deviation of the difference in SOC stocks between t0 and t1
Source of data	Estimation of the smallest difference in SOC stocks between two monitoring events that may be detected as statistically significant
Description of measurement methods and procedures to be applied	See Section 8.2.1 of the VM0042 methodology
Frequency of monitoring/recording	At least every five years, or prior to each verification event if less than five years
Value applied	N/A, modeled values
Monitoring equipment	N/A, modeled values
QA/QC procedures to be applied	See Section 8.2.1 and further guidance in FAO (2019)
Purpose of data	Development of sampling strategy for baseline setting and measurements for monitoring
Calculation method	See Section 8.2.1 of the VM0042 methodology
Comments	Calculation of the number of samples required to detect a minimum difference is optional.

Data / Parameter	*N*
Data unit	Dimensionless
Description	Number of samples required to detect a minimum difference
Source of data	Estimation of the smallest difference in SOC stocks between two monitoring events that may be detected as statistically significant
Description of measurement methods and procedures to be applied	See Section 8.2.1 of the VM0042 methodology
Frequency of monitoring/recording	At least every five years, or prior to each verification event if less than five years
Value applied	N/A, modeled values
Monitoring equipment	N/A, modeled values
QA/QC procedures to be applied	See Section 8.2.1 and further guidance in FAO (2019)
Purpose of data	Development of sampling strategy for baseline setting and measurements for monitoring
Calculation method	See Section 8.2.1 of the VM0042 methodology
Comments	Calculation of the number of samples required to detect a minimum difference is optional.

Data / Parameter	*n* – 1
Data unit	Dimensionless
Description	Degrees of freedom for the relevant t-distribution
Source of data	Estimation of the smallest difference in SOC stocks between two monitoring events that may be detected as statistically significant
Description of measurement methods and procedures to be applied	See Section 8.2.1 of the VM0042 methodology

Frequency of monitoring/recording	At least every five years, or prior to each verification event if less than five years
Value applied	N/A, modeled values
Monitoring equipment	N/A, modeled values
QA/QC procedures to be applied	See Section 8.2.1 and further guidance in FAO (2019)
Purpose of data	Development of sampling strategy for baseline setting and measurements for monitoring
Calculation method	See Section 8.2.1 of the VM0042 methodology
Comments	Calculation of the number of samples required to detect a minimum difference is optional.

Data / Parameter	*tx,u*
Data unit	Dimensionless
Description	Values of the t-distribution given a certain power level (1 − b) and a significance level.
Source of data	Estimation of the smallest difference in SOC stocks between two monitoring events that may be detected as statistically significant
Description of measurement methods and procedures to be applied	See Section 8.2.1 of the VM0042 methodology
Frequency of monitoring/recording	At least every five years, or prior to each verification event if less than five years
Value applied	N/A, modeled values
Monitoring equipment	N/A, modeled values
QA/QC procedures to be applied	See Section 8.2.1 and further guidance in FAO (2019)
Purpose of data	Development of sampling strategy for baseline setting and measurements for monitoring

Calculation method	See Section 8.2.1 of the VM0042 methodology
Comments	Calculation of the number of samples required to detect a minimum difference is optional.

Data / Parameter	Latitude
Data unit	Degrees (°)
Description	Site latitude
Source of data	Historical management data, attestation letters, imagery or regional average values derived from literature and databases will be used, depending on data availability and following the requirements on BOX 1.
Description of measurement methods and procedures to be applied	Currently, USGS (https://www.usgs.gov/) database is used to estimate this parameter.
Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Modelling baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	Longitude
Data unit	Degrees (°)
Description	Site longitude

Source of data	Historical management data, attestation letters, imagery or regional average values derived from literature and databases will be used, depending on data availability and following the requirements on BOX 1.
Description of measurement methods and procedures to be applied	Currently, USGS (https://www.usgs.gov/) database is used to estimate this parameter.
Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Modelling baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	Elevation
Data unit	m
Description	Site elevation above sea level
Source of data	Historical management data, attestation letters, imagery or regional average values derived from literature and databases will be used, depending ondata availability and following the requirements on BOX 1.
Description of measurement methods and procedures to be applied	Currently, USGS (https://www.usgs.gov/) database is used to estimate this parameter.
Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value applied	N/A

Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Modelling baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	Daily_Maximum_Air_Temperature
Data unit	°C
Description	Daily maximum air temperature on site
Source of data	Historical management data or regional average values derived from literature and databases will be used, depending on data availability and following the requirements on BOX 1.
Description of measurement methods and procedures to be applied	See "Source of data". Currently, this parameter is being taken from the PRISM database (https://prism.oregonstate.edu/), from Oregon State University.
Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value applied	Specific for each grower applying cover crop(s)
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Modelling baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	Daily_Minimum_Air_Temperature
Data unit	°C
Description	Daily minimum air temperature on site

Source of data	Historical management data or regional average values derived from literature and databases will be used, depending on data availability and following the requirements on BOX 1.
Description of measurement methods and procedures to be applied	See "Source of data". Currently, this parameter is being taken from the PRISM database (https://prism.oregonstate.edu/), from Oregon State University.
Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Modelling baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	Average_Daily_Precipitation
Data unit	cm/day
Description	Average daily precipitation on site
Source of data	Historical management data or regional average values derived from literature and databases will be used, depending on data availability and following the requirements on BOX 1.
Description of measurement methods and procedures to be applied	See "Source of data". Currently, this parameter is being taken from the PRISM database (https://prism.oregonstate.edu/), from Oregon State University.
Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A

Purpose of data	Modelling baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	Solar radiation
Data unit	ly/day
Description	Average solar radiation on site
Source of data	SOC model applied
Description of measurement methods and procedures to be applied	See “Calculation method”
Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Modelling baseline and project emissions
Calculation method	Currently, this parameter is automatically calculated in the SOC model according to other climate and geography inputs.
Comments	None

Data / Parameter	Relative humidity
Data unit	%
Description	Relative humidity on site
Source of data	SOC model applied
Description of measurement methods and procedures to be applied	See “Calculation method”

Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Modelling baseline and project emissions
Calculation method	Currently, this parameter is automatically calculated in the SOC model according to other climate and geography inputs.
Comments	None

Data / Parameter	Wind speed
Data unit	mph
Description	Average wind speed on site
Source of data	SOC model applied
Description of measurement methods and procedures to be applied	See "Calculation method"
Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Modelling baseline and project emissions
Calculation method	Currently, this parameter is automatically calculated in the SOC model according to other climate and geography inputs.
Comments	None

Data / Parameter	Soil texture
Data unit	Fraction
Description	Sand, silt and clay fractions for each soil layer
Source of data	Historical management data, attestation letters, imagery or regional average values derived from literature and databases will be used, depending on data availability and following the requirements on BOX 1.
Description of measurement methods and procedures to be applied	Currently, SSURGO ((https://www.nrcs.usda.gov/conservation-basics/natural-resource-concerns/soil/annual-refresh-of-soil-survey-data) database is used to estimate this parameter.
Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value applied	n/a
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Modelling baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	pH
Data unit	Dimensionless
Description	Soil pH for each soil layer
Source of data	Historical management data, attestation letters, imagery or regional average values derived from literature and databases will be used, depending on data availability and following the requirements on BOX 1.

Description of measurement methods and procedures to be applied	Currently, SSURGO ((https://www.nrcs.usda.gov/conservation-basics/natural-resource-concerns/soil/annual-refresh-of-soil-survey-data) database is used to estimate this parameter.
Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Modelling baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	Wilting point
Data unit	cm^3
Description	Minimum water level in the soil required for plants not to wilt for each soil layer
Source of data	Historical management data, attestation letters, imagery or regional average values derived from literature and databases will be used, depending on data availability and following the requirements on BOX 1.
Description of measurement methods and procedures to be applied	See "Source of data". Currently, the program mksitesoil (https://www.nrel.colostate.edu/wp-content/uploads/2019/04/DayCent_Step_by_Step.pdf) is used to estimate this parameter based on other soil and climate inputs.
Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value applied	N/A
Monitoring equipment	N/A

QA/QC procedures to be applied	N/A
Purpose of data	Modelling baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	Field capacity
Data unit	cm^3
Description	Water content present in the soil after excess water is drained through gravity for each soil layer
Source of data	Historical management data, attestation letters, imagery or regional average values derived from literature and databases will be used, depending on data availability and following the requirements on BOX 1.
Description of measurement methods and procedures to be applied	See "Source of data". Currently, the program mksitesoil (https://www.nrel.colostate.edu/wp-content/uploads/2019/04/DayCent_Step_by_Step.pdf) is used to estimate this parameter based on other soil and climate inputs.
Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Modelling baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	Root fraction

Data unit	Fraction
Description	Fraction of roots for each soil layer
Source of data	Historical management data, attestation letters, imagery or regional average values derived from literature and databases will be used, depending on data availability and following the requirements on BOX 1.
Description of measurement methods and procedures to be applied	See "Source of data". Currently, the program mksitesoil (https://www.nrel.colostate.edu/wp-content/uploads/2019/04/DayCent_Step_by_Step.pdf) is used to estimate this parameter based on other soil and climate inputs.
Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Modelling baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	Organic_Matter_Fraction
Data unit	Fraction
Description	Fraction of organic matter for each soil layer
Source of data	Historical management data, attestation letters, imagery or regional average values derived from literature and databases will be used, depending on data availability and following the requirements on BOX 1.
Description of measurement methods and procedures to be applied	See "Source of data". Currently, the program mksitesoil (https://www.nrel.colostate.edu/wp-content/uploads/2019/04/DayCent_Step_by_Step.pdf) is used to estimate this parameter based on other soil and climate inputs.

Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Modelling baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	Ksat
Data unit	cm/s
Description	Saturated hydraulic conductivity for each soil layer
Source of data	Historical management data, attestation letters, imagery or regional average values derived from literature and databases will be used, depending on data availability and following the requirements on BOX 1.
Description of measurement methods and procedures to be applied	See "Source of data". Currently, the program mksitesoil (https://www.nrel.colostate.edu/wp-content/uploads/2019/04/DayCent_Step_by_Step.pdf) is used to estimate this parameter based on other soil and climate inputs.
Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Modelling baseline and project emissions
Calculation method	N/A

Comments	None

Data / Parameter	Evap_Coeff
Data unit	Dimensionless
Description	Evapotranspiration coefficient for each soil layer
Source of data	Historical management data, attestation letters, imagery or regional average values derived from literature and databases will be used, depending on data availability and following the requirements on BOX 1.
Description of measurement methods and procedures to be applied	See "Source of data". Currently, the program mksitesoil (https://www.nrel.colostate.edu/wp-content/uploads/2019/04/DayCent_Step_by_Step.pdf) is used to estimate this parameter based on other soil and climate inputs.
Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Modelling baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	ΔMin
Data unit	cm^3
Description	Residual moisture for each soil layer
Source of data	Historical management data, attestation letters, imagery or regional average values derived from literature and databases will be used, depending on data availability and following the requirements on BOX 1.

Description of measurement methods and procedures to be applied	See "Source of data". Currently, the program mksitesoil (https://www.nrel.colostate.edu/wp-content/uploads/2019/04/DayCent_Step_by_Step.pdf) is used to estimate this parameter based on other soil and climate inputs.
Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Modelling baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	Thickness
Data unit	cm
Description	Thickness of each soil layer
Source of data	Historical management data, attestation letters, imagery or regional average values derived from literature and databases will be used, depending on data availability and following the requirements on BOX 1.
Description of measurement methods and procedures to be applied	See "Source of data". Currently, the program mksitesoil (https://www.nrel.colostate.edu/wp-content/uploads/2019/04/DayCent_Step_by_Step.pdf) is used to estimate this parameter based on other soil and climate inputs.
Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value applied	N/A
Monitoring equipment	N/A

QA/QC procedures to be applied	N/A
Purpose of data	Modelling baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	Upper_Depth
Data unit	cm
Description	Maximum depth of each soil layer
Source of data	Historical management data, attestation letters, imagery or regional average values derived from literature and databases will be used, depending on data availability and following the requirements on BOX 1.
Description of measurement methods and procedures to be applied	See "Source of data". Currently, the program mksitesoil (https://www.nrel.colostate.edu/wp-content/uploads/2019/04/DayCent_Step_by_Step.pdf) is used to estimate this parameter based on other soil and climate inputs.
Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Modelling baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	Lower_Depth
Data unit	cm

Description	Minimum depth of each soil layer
Source of data	Historical management data, attestation letters, imagery or regional average values derived from literature and databases will be used, depending on data availability and following the requirements on BOX 1.
Description of measurement methods and procedures to be applied	See "Source of data". Currently, the program mksitesoil (https://www.nrel.colostate.edu/wp-content/uploads/2019/04/DayCent_Step_by_Step.pdf) is used to estimate this parameter based on other soil and climate inputs.
Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Modelling baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	CC_type
Data unit	Categorical value
Description	Cover Crop species type in the baseline and/or project scenario
Source of data	Historical management data, attestation letters, imagery or regional average values derived from literature and databases will be used, depending on data availability and following the requirements on BOX 1.
Description of measurement methods and procedures to be applied	See "Source of data".

Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Modelling baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	CC_Planting_Date
Data unit	Date in MM/DD/YYYY format
Description	Date of the crop planting in the baseline and/or project scenario
Source of data	Historical management data, attestation letters, imagery or regional average values derived from literature and databases will be used, depending on data availability and following the requirements on BOX 1.
Description of measurement methods and procedures to be applied	See “Source of data”.
Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Modelling baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	CC_Termination_Date
Data unit	Date in MM/DD/YYYY format
Description	Cover Crop termination date in the baseline and/or project scenario
Source of data	Historical management data, attestation letters, imagery or regional average values derived from literature and databases will be used, depending on data availability and following the requirements on BOX 1.
Description of measurement methods and procedures to be applied	See "Source of data".
Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Modelling baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	CC_Termination_Method
Data unit	Categorical value
Description	Cover Crop termination method(s) in the baseline and/or project scenario
Source of data	Historical management data, attestation letters, imagery or regional average values derived from literature and databases will be used, depending on data availability and following the requirements on BOX 1.

Description of measurement methods and procedures to be applied	See “Source of data”. Currently, data is collected on whether the cover crop was terminated using a herbicide, mechanically, or winter kill (senseance).
Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Modelling baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	Date_Applied_SN
Data unit	Date in MM/DD/YYYY format
Description	Application Date of the synthetic fertiliser in the baseline and/or project scenario
Source of data	Historical management data, attestation letters, imagery or regional average values derived from literature and databases will be used, depending on data availability and following the requirements on BOX 1.
Description of measurement methods and procedures to be applied	See “Source of data”.
Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A

Purpose of data	Modelling baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	Date_Applied_OF
Data unit	Date in MM/DD/YYYY format
Description	Application Date of the organic fertilizer in the baseline and/or project scenario
Source of data	Historical management data, attestation letters, imagery or regional average values derived from literature and databases will be used, depending on data availability and following the requirements on BOX 1.
Description of measurement methods and procedures to be applied	See "Source of data".
Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Modelling baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	Plant_Species
Data unit	Categorical value
Description	Cash Crop species type in the baseline and/or project scenario

Source of data	Historical management data, attestation letters, imagery or regional average values derived from literature and databases will be used, depending on data availability and following the requirements on BOX 1.
Description of measurement methods and procedures to be applied	See "Source of data".
Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Modelling baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	Planting_Date
Data unit	Date in MM/DD/YYYY format
Description	Date of the crop planting in the baseline and/or project scenario
Source of data	Historical management data, attestation letters, imagery or regional average values derived from literature and databases will be used, depending on data availability and following the requirements on BOX 1.
Description of measurement methods and procedures to be applied	See "Source of data".
Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value applied	N/A

Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Modelling baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	Harvest_Method
Data unit	Categorical value
Description	Harvest method in the baseline and/or project scenario
Source of data	Historical management data, attestation letters, imagery or regional average values derived from literature and databases will be used, depending on data availability and following the requirements on BOX 1.
Description of measurement methods and procedures to be applied	See "Source of data".
Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Modelling baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	Yield
Data unit	kg/ha

Description	Yield of cash crop species in the baseline and/or project scenario
Source of data	Historical management data, attestation letters, imagery or regional average values derived from literature and databases will be used, depending on data availability and following the requirements on BOX 1.
Description of measurement methods and procedures to be applied	See "Source of data".
Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Modelling baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	Harvest_Date
Data unit	Date in MM/DD/YYYY format
Description	Date of the crop harvest in the baseline and/or project scenario
Source of data	Historical management data, attestation letters, imagery or regional average values derived from literature and databases will be used, depending on data availability and following the requirements on BOX 1.
Description of measurement methods and procedures to be applied	See "Source of data".
Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.

Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Modelling baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	Tillage_Date
Data unit	Date in MM/DD/YYYY format
Description	Date of the reduced tillage / no till event in the baseline and/or project scenario
Source of data	Historical management data, attestation letters, imagery or regional average values derived from literature and databases will be used, depending on data availability and following the requirements on BOX 1.
Description of measurement methods and procedures to be applied	See “Source of data”.
Frequency of monitoring/recording	At least every five years, or prior to each verification eventwhere verification occurs more frequently.
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Modelling baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	Tillage_Type
Data unit	Categorical value
Description	Type of tillage applied in the baseline and/or project scenario
Source of data	Historical management data, attestation letters, imagery or regional average values derived from literature and databases will be used, depending on data availability and following the requirements on BOX 1.
Description of measurement methods and procedures to be applied	See “Source of data”.
Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to beapplied	N/A
Purpose of data	Modelling baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	Tillage_Intensity
Data unit	Dimensionless
Description	Degree of soil disturbance from tillage operations
Source of data	Historical management data, attestation letters, imagery or regional average values derived from literature and databases will be used, depending on data availability and following the requirements on BOX 1.
Description of measurement methods and procedures to be applied	See “Source of data”.

Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Modelling baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	Tillage_Depth
Data unit	cm
Description	Soil depth disturbed due to tillage.
Source of data	Historical management data, attestation letters, imagery or regional average values derived from literature and databases will be used, depending on data availability and following the requirements on BOX 1.
Description of measurement methods and procedures to be applied	See “Source of data”.
Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Modelling baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	Tillage_Implement
Data unit	Categorical value
Description	Implement used during tillage event.
Source of data	Historical management data, attestation letters, imagery or regional average values derived from literature and databases will be used, depending on data availability and following the requirements on BOX 1.
Description of measurement methods and procedures to be applied	See "Source of data".
Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Modelling baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	Irrigation_Amount
Data unit	cm
Description	Amount of water applied for irrigation in the baseline and/or project scenario
Source of data	Historical management data, attestation letters, imagery or regional average values derived from literature and databases will be used, depending on data availability and following the requirements on BOX 1.
Description of measurement methods and procedures to be	See "Source of data". Currently estimated in the model based on climate and soil parameters. In the future, data might be collected

applied	depending on data availability and following the requirements on BOX 1.
Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Modelling baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	Irrigation_Start_Date
Data unit	Date in MM/DD/YYYY format
Description	Start date of irrigation event in the baseline and/or project scenario
Source of data	Historical management data, attestation letters, imagery or regional average values derived from literature and databases will be used, depending on data availability and following the requirements on BOX 1.
Description of measurement methods and procedures to be applied	See "Source of data". Currently estimated in the model based on climate and soil parameters. In the future, data might be collected depending on data availability and following the requirements on BOX 1.
Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A

Purpose of data	N/A
Calculation method	Modelling baseline and project emissions
Comments	None

Data / Parameter	Irrigation_End_Date
Data unit	Date in MM/DD/YYYY format
Description	End date of irrigation applied in the baseline and/or project scenario
Source of data	Historical management data, attestation letters, imagery or regional average values derived from literature and databases will be used, depending on data availability and following the requirements on BOX 1.
Description of measurement methods and procedures to be applied	See "Source of data". Currently estimated in the model based on climate and soil parameters. In the future, data might be collected depending on data availability and following the requirements on BOX 1.
Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	N/A
Calculation method	Modelling baseline and project emissions
Comments	None

Data / Parameter	Grain, strawStoverHayRemoval
Data unit	%
Description	Percentage of residue removed

Source of data	Historical management data, attestation letters, imagery or regional average values derived from literature and databases will be used, depending on data availability and following the requirements on BOX 1.
Description of measurement methods and procedures to be applied	Representing how the crop was harvested to determine % residue removal. e.g., grain only (0%), grain with straw, stover or residue removal (assigning 50% as an average based on literature review), bailed straw (assigning 30% based on literature review) in the baseline and/or project scenario.
Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Modelling baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	Organic Fertilizer Application
Data unit	t/ha or kg/ha
Description	Organic fertilizer application rate
Source of data	Historical management data, attestation letters, imagery or regional average values derived from literature and databases will be used, depending on data availability and following the requirements on BOX 1.
Description of measurement methods and procedures to be applied	See “Source of data”. Values for N rate are derived from the University of Nebraska-Lincoln Extension (2021) to calculate the percentage of nitrogen, as these values provide essential data for determining nutrient content in soil and fertilizer applications (University of Nebraska-Lincoln Extension, 2021).

Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value Monitored	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	Agoro Carbon staff agronomist ensures data is accurate by comparing baseline data and regional norms. If there are major deviations/ irregularities in the data, staff agronomists will contact the grower and reassess their data input with them.
Purpose of Data	Calculation of baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	Organic Fertilizer Type
Data unit	Categorical value
Description	Organic fertilizer type according to animal source and residue management
Source of data	Historical management data, attestation letters, imagery or regional average values derived from literature and databases will be used, depending on data availability and following the requirements on BOX 1.
Description of measurement methods and procedures to be applied	See “Source of data”
Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value Monitored	N/A
Monitoring equipment	N/A
QA/Q procedures to be applied	Agoro Carbon staff agronomist ensures data is accurate by comparing baseline data and regional norms. If there are major

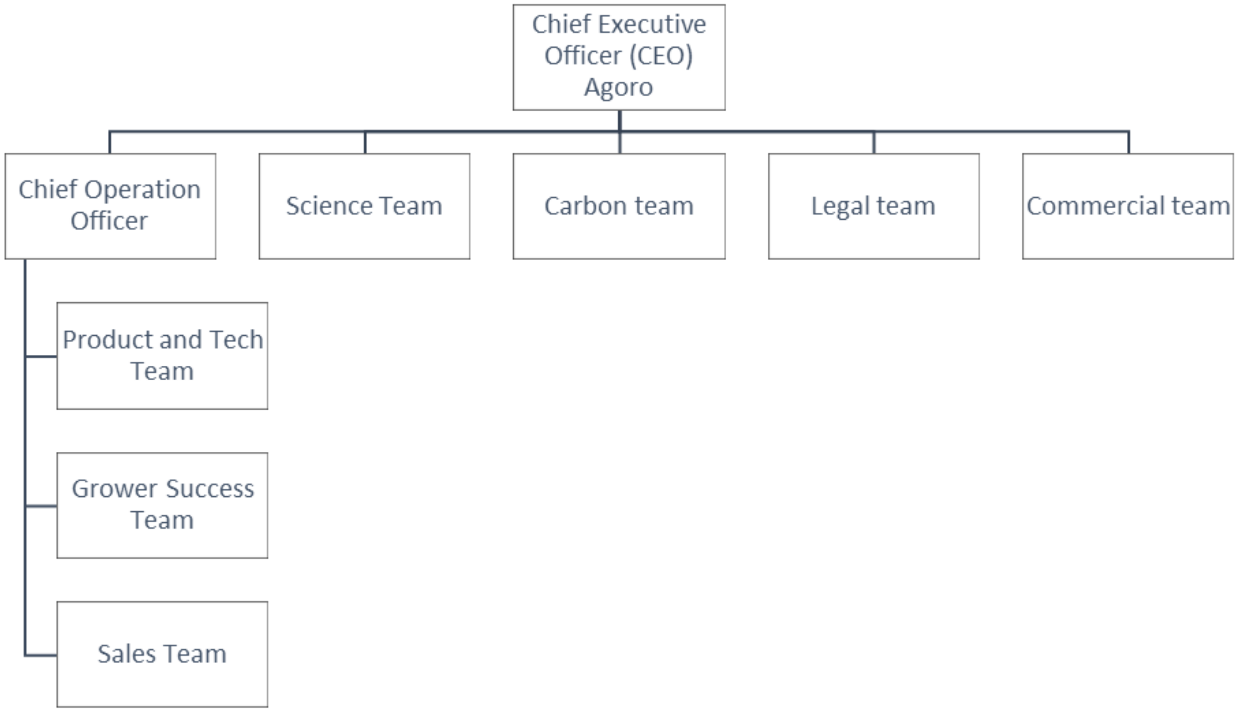
	deviations/ irregularities in the data, staff agronomists will contact the grower and reassess their data input with them.
Purpose of Data	Calculation of baseline and project emissions
Calculation method	N/A
Comments	None

Data / Parameter	Synthetic Fertilizer Application
Data unit	t/ha or kg/ha
Description	Synthetic fertilizer application rate
Source of data	Historical management data, attestation letters, imagery or regional average values derived fromliterature and databases will be used, depending on data availability and following the requirements on BOX 1.
Description of measurement methods and procedures to be applied	See "Source of data". Values for N rate are derived from N concentration rates according to fertilizer type on IPCC 2019 or other applicable literature.
Frequency of monitoring/recording	At least every five years, or prior to each verification event where verification occurs more frequently.
Value Monitored	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	Agoro Carbon staff agronomist ensures data is accurate by comparing baseline data and regional norms. If there are major deviations/ irregularities in the data, staff agronomists will contact the grower and reassess their data input with them.
Purpose of Data	Calculation of baseline and project emissions
Calculation method	N/A
Comments	None

5.3 Monitoring Plan

Organizational structure of the project

The organizational structure of Agoro Carbon, responsibilities and competencies of the personnel that will be carrying out monitoring activities is presented in the figure below:



The overall coordination of the project activities is conducted by the Carbon Team (CT) of Agoro Carbon, reporting to the CEO of the company. The team is responsible for project MRV coordination, compiling documentation for project validation and verification, developing carbon project design, setting up monitoring and verification activities and assuring that project development and operation is conducted in line with the Verra requirements. The team is composed currently of several members, each responsible for different design elements of the project. Absolute majority of the team members have been involved in the past in carbon project development under VCS and audit of carbon projects.

The responsibility for baseline and project data management and evidence collection, data analysis and storage, data QA/QC processes and customer support for producers throughout the duration of their contract lies within the Grower Success Team (GST). The Grower Success Team assumes responsibility for collecting, analyzing, and storing historical and monitoring data and evidence related to the MRV. Furthermore, the team is responsible for performing quality assurance and quality control checks on the data, as well as for collecting yearly monitoring data and supporting evidence. In addition, the team is responsible for the development and monitoring of the individual plan for each farmer enrolled in the Program for the project practices implementation and ensuring that the contract is adhered to, while providing continuous agronomic support and guidance to the farmers on following the implementation plan.

The team is composed of highly skilled agronomists who also have experience as producers, specializing in various areas such as conservation practices, precision agriculture, ag data, seed, chemistry, nutrition, and manure management. Together, the team boasts an impressive 142 years of field experience and 49 years of education, gained from prominent companies as well as renowned organizations like Soil Health Partnership, Colorado State University, USDA (ARS), Michigan State University, and Oklahoma State University.

Project tasks related to stratification of project area, soil sampling processes and GHG modelling and quantification are performed by the Science team (ST). The team is responsible for carbon and other greenhouse gas (GHG) modelling and quantification, which is required under VCS for the certification of soil organic carbon (SOC) stocks in grower fields in line with rigorous scientific standards. The team also performs QA/QC processes on the data analyzed. These activities are necessary in order to evaluate the amount of SOC sequestration associated with the regenerative agricultural practices that project farmers are going to implement on their contracted hectares.

To achieve this objective, Agoro Carbon has assembled a team of highly skilled scientists with diverse expertise in areas such as remote sensing/geospatial procedures, carbon and other GHG modelling methodology, pasture and range management methodology, agronomic management and soil science.

Product and tech team is developing digital solutions to enable more effective enrollment of the farmers to the Agoro Carbon Platform and to allow the farmers to assess their carbon potential from project practices implementation. Further, the team is performing part of QA/QC tasks on a regular basis to check the correctness of data input on the acreages enrolled in the Program.

The activities related to the initial engagement of the farmers into Agoro Carbon Program, ex-ante estimation of emission reductions for specific fields, drafting and signing the contract with the farmers for the implementation of the project practices are performed by our Sales Team. Presently, the team comprises several members with a wide range of expertise in various aspects of agriculture, which are key areas of our operations.

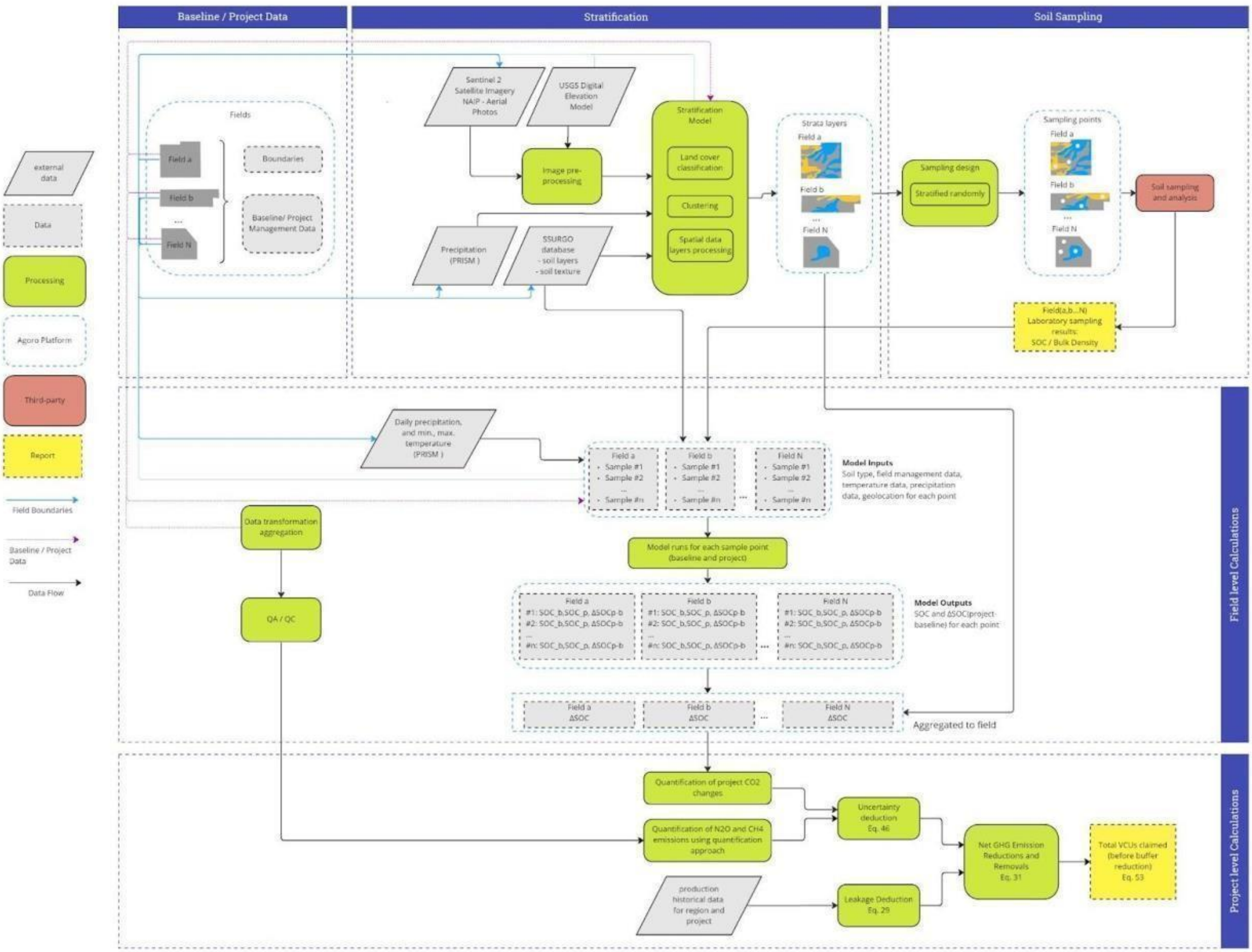
Legal team of Agoro Carbon supports the project in analyzing and implementing the regulatory requirements, creating necessary documentation for the enrolled of the farmers into the Program. The team is also responsible for handling all legal matters related to contractual relationships with farmers.

Commercial team of Agoro Carbon handles all communication and interactions related to the sale of the carbon credits.

The breadth of knowledge and skills within the teams ensures that Agoro Carbon adheres to Verra's methodologies and utilizes best-in-class procedures for the verification of carbon credits.

<u>GHG information system</u>

GHG information system for obtaining, recording, compiling, and analyzing data and information important for quantifying and reporting GHG emissions and/or removals relevant for the project (including leakage) and baseline scenario is presented in the Figure below.



The methods for measuring, recording, storing, aggregating, collating and reporting data and parameters as well as anticipated frequency of monitoring will be followed as described in Sections 5.1. and 5.2 of the PDD in the corresponding sections for each parameters and as described further below. Sections 5.1. and 5.2 also outlines what type of data and in which format the data is already collected or is going to be collected for the project, including parameters to be measured and parameters required for the DayCent model.

Data collection and storage

VM0042 specifies that the agricultural management information a project must collect depends on the input variables required by the model used (Quantification approach 1, Measure and model) to quantify soil organic carbon stock change, as well as the variables required to estimate the gases included in the project boundary quantified using Quantification Approach 3 (e.g. N2O emissions from use of organic amendments or synthetic nitrogen (N) fertilizers). Box 1 in VM0042 distinguishes between the preferred data sources for qualitative versus quantitative data. Qualitative information is determined by consultation with, and substantiated with a signed attestation from, the grower or landowner of the field. Quantitative information is sourced as available according to the hierarchy of preferred sources outlined in Box 1, in the following order: historical management records or remote sensing, historical management plans, grower attested values that align with values for similar fields, or regional values. Grower field data will be used for project scenario data. Grower field data is preferred for baseline data but attestations or regional data will be utilized for instances where grower field data is not available.

The primary data collection for the farmers-specific baseline data and the project monitored data, as presented in Section 5.2. of the PDD, is conducted by the grower success team agronomists. The agronomists of the grower success team, during their first field visits to the farms, discussed needed data and documentation with the farmers during their onboarding phase. The baseline data for initial project instances was recorded by agronomists, taking into consideration producer historical and practice change data for PDD and carbon modelling. In the future, all the data will be collected through the Agoro Carbon data management platform deployed in AWS. Field boundaries of the farmers enrolled are initially entered into a software application called Agrian via the import of provided digital files from farmers or their business partners or digitally drawn in the software. These boundaries are then exported out of Agrian as shapefiles and served as input for the stratification process. Currently this process is also migrating to Agoro Carbon Platform.

Project data reported during the monitoring stage of the project is planned to be collected and stored in the Agoro Carbon data management platform. In addition, during on-farm support visits with enrolled farmers, the agronomists will be taking images of fields to compare 'before' and 'after' views and assess the effectiveness of the implementation plan for the farmers for the implementation of project practices, which will be also stored on the Agoro Carbon Platform.

Agoro Carbon will maintain a stable backend database in which all relevant data for project monitoring will be stored. All farmers and fields are assigned unique IDs to which management data, sample data, and model runs will be associated through a relational database system.

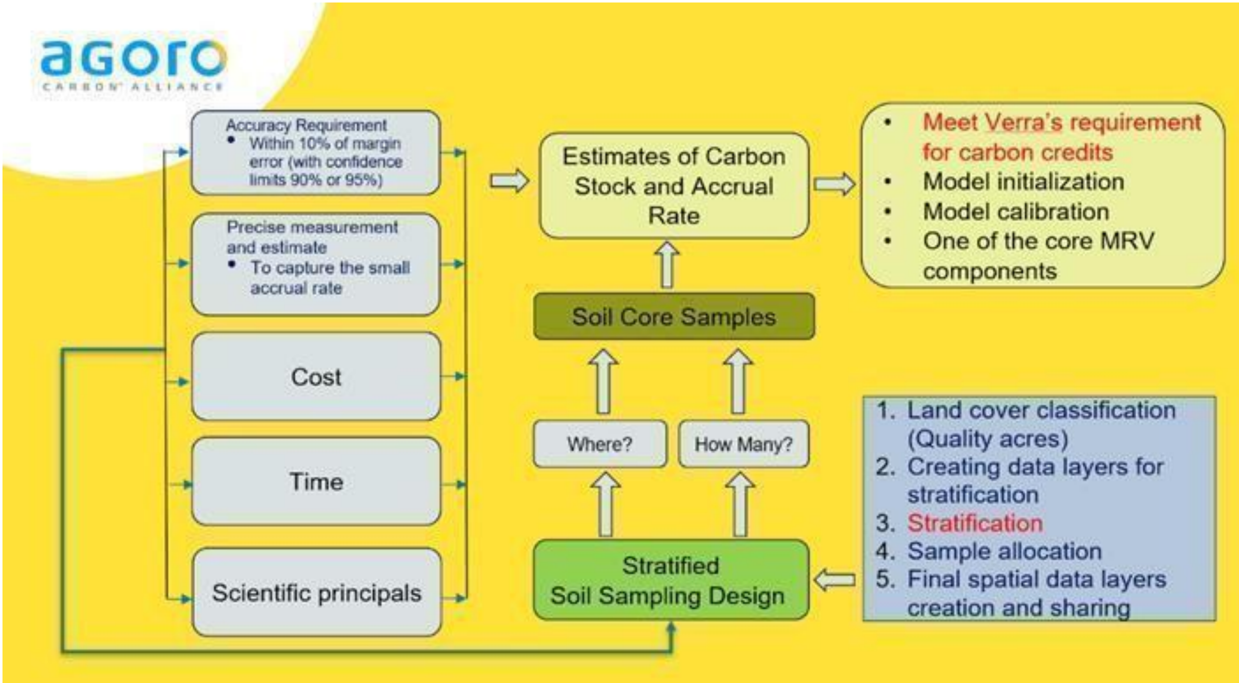
Data will be archived for the entire project period. Should any file formats or data models be updated, all prior datasets will be made forward compatible to permit continued comparison throughout the project period. All documents and records will be kept in a secure and retrievable manner for at least two years after the end of the project crediting period.

Agoro Carbon will be also responsible for all data archiving and maintenance of DayCent, and regular evaluation and/or maintenance of Agoro Carbon's various data services that provide the necessary inputs for the DayCent model.

Sampling design

Soil carbon stock levels have considerable spatial variability within any given field. The spatial heterogeneity of SOC presents a significant challenge to project developers like Agoro Carbon to measure SOC with the accuracy required by the VCS. In addition to the spatial heterogeneity issues, many other principles of climate farming practices and relationships between the producer and the project developers complicate the carbon measurement via the sampling process. Also, it is economically impossible to sample and measure SOC for the entire area of a given field. Therefore, a strategic sampling design that balances all these factors is needed to implement a successful carbon project.

Agoro Carbon has developed a soil sampling design protocol to collect soil cores for soil organic carbon stock estimates. The protocol complies with the requirements by VM0042 but with more workable and achievable steps that can be implemented for commercial operations with considerations for cost, efficiency, quality, and SOC estimated accuracy. The protocol includes five key steps from quality land classification to the final stage of data sharing and QA/QC evaluation by stakeholders (Figure 1). For each step, the data sources, methods, and justification with a literature review for the scientific merit of the approach are provided to indicate the validity, certainty, and simplicity of the approaches. More details on this process are provided in the Agoro Carbon Standard Operation Procedure (SOP) Report_Sampling_Design.



<u>Stratification</u>

Soil sampling design starts with the definition of the stratification process which is used to divide the producer's farm into segments of land, which is going to be used to define points where the soil sampling is going to take place. Stratified, random sampling design is used by the project, which implies stratifying heterogeneous landscapes with varying soil carbon content into stratum by using different data layers, or covariants that are highly correlated to soil carbon. Each stratum represents a relatively homogenous subunit of land with minimal variation of SOC within a given stratum subunit; and maximum differences of SOC across the different strata, which is a more accurate representation of a field's SOC content than a random sampling approach. After the strata are created, sampling locations are randomly assigned for each stratum separately.

Agoro Carbon's goal is to estimate soil carbon stock at the project's initial stage, again at year five, and finally in year ten at the conclusion of grower carbon contracts with the necessary accuracy, while meeting Agoro Carbon's business mission and operation schedules. Following VCS requirements, Agoro Carbon has customized and developed an operational sampling design approach to ensure a margin of error of less than 10% at the 90% confidence level.

Agoro Carbon defines the total area (hectares) of land enrolled in its carbon project by each producer as the unit or population to be sampled and analyzed for SOC, allowing Agoro Carbon to report the mean carbon stock for each grower's property along with the estimated uncertainty, standard deviation and confidence limits of the estimate.

Stratification process is performed by using a stratified random sampling design, with the samples randomly allocated to each stratum. The approach utilizes five steps (Fig. 1) involved in designing a sampling scheme that maximizes the accuracy of carbon measurement while minimizing the cost, which includes 1) Land cover classification, 2) Creating data layers for stratification, 3) Stratification, 4) Sample allocation, and 5) Final spatial data layers creating and sharing.

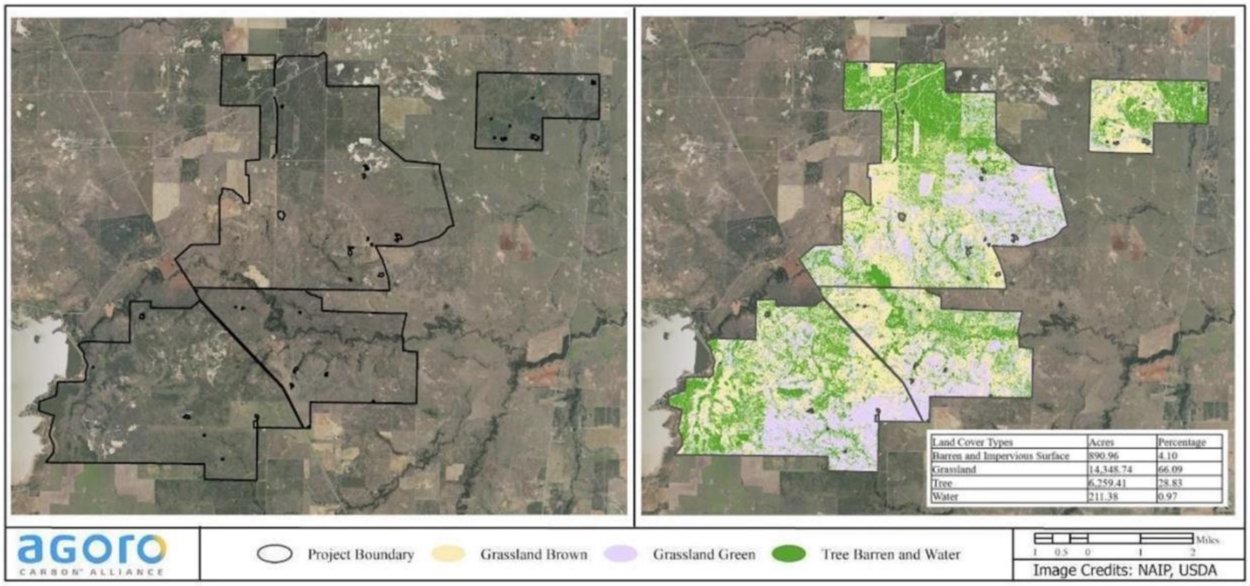
For the purpose of stratification, land cover classification is based on aerial photos which are obtained from the National Agriculture Imagery Program (NAIP) of the USDA, and satellite imagery of Sentinel-2 and Landsat 8-9. The classification is completed by using an object-oriented approach and Random Forest (RF) machine learning algorithm provided in eCognition software package.

The data layers, potentially having covariations with SOC, including topographic position (Topographic Position index (TPI) and Topographic Wetness Index (TWI)), soil texture, slope, Normalized Difference Vegetation Index (NDVI), soil color index (CI), and precipitation, were created for Agoro Carbon's land stratification. The data from publicly available sources were processed with standardized procedures and tools provided in the ArcGIS software package (www.esri.com). Besides those layers, polygon layers detailing the property boundary and areas where management practices are implemented were also created with information provided by farmers.

The process of stratification, i.e. subsetting the land into strata, was performed based on the similarity of the combined data layers: land cover, slope position, soil texture (fractions of clay, sand, and silt), TWI, NDVI, CI, precipitation, and management unit. Two standard procedures for cluster analysis from SAS (www.sas.com), Proc Fastclus and Proc Cluster representing K-means and Hierarchical cluster methods were used for this purpose. Sample allocation to each stratum of all the strata per a grower's property was completed with the statistical survey data analysis procedures available in SAS, Proc Surveyselect.

After completion of sampling allocation, a point GIS data layer was created with unique identification of CoreID, and other associated attributes. A polygon GIS data layer was also created with two attributes of land cover classification and stratification codes.

An example of stratification results – identification of different strata and soil sample locations designed for soil sampling and analysis is shown in Figures below.



The outputs from stratification with samples to be taken for soil analysis were checked for points that are in a place that is not reachable, etc., to exclude those from the soil sampling process. After this AQ/QC process, the location of the points to be sampled were sent to the soil sampling company.

<u>Soil sampling and analysis</u>

Soil sampling and analysis is needed in order to determine how much carbon is in the soil at the beginning of project implementation. The result of the soil analysis is going to be compared after 5 and 10 years, in order to quantify how much carbon has been sequestered as result of project activity implementation.

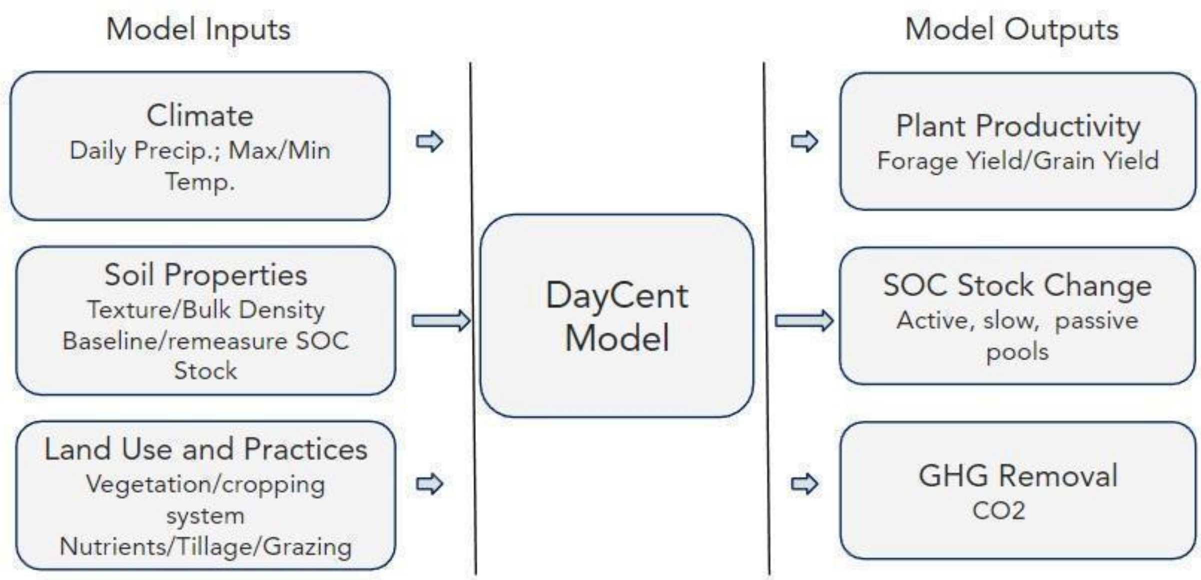
For the soil sampling and analysis of soil samples Agoro Carbon is using third parties (soil sampling partner). Soil sampling partner is the one in charge of taking the soil samples and sending the soil samples to the lab. After the sample is collected and documented, they are sent to the accredited laboratories so they can run their test for SOC determination. The parameters analysis by the laboratories included inter alia Soil Bulk Density (Dry) and Total Carbon, % (from dry combustion).

The results of soil sample analysis are then sent to Agoro Carbon back in a .CSV and .PDF format, already paired with the locations of the samples. Laboratory results of soil sample analyses are reviewed for outliers and errors before being submitted for baselining process and modelling baseline emissions. Soil sampling and analysis is performed according to an internal SOP titled Agoro Carbon Lab Testing Services Workflow.

The information on sampling approaches used, including sample sizes and sample site locations is further specified in the internal document “Protocol for Measuring Soil Organic Carbon Stock in the US Project Area”.

Modelling design

For estimating net impact of project activities on soil carbon stocks across the project area and modelling CO2 emissions the project will use the DayCent model. Because of its ability to model SOC to a depth 30 cm, and applicability to project domain the DayCent model was selected over other competing models for estimating SOC and issuing carbon credit in years in between soil sampling events. Primary inputs and outputs of the model are depicted in the Figure below.



DayCent model has been validated as per the procedures outlined in VMD0053 and described in the corresponding Model Validation Report (MVR). The MVR includes more extensive detail on model calibration, validation, and uncertain assessment. The procedure for calculating uncertainty have been included in Appendix 3: Uncertainty. Additionally, it includes the modeling plan for the carbon crediting project, along with details of all validation datasets and the quality assurance/quality control (QA/QC) procedures implemented. To be specific, the detailed description of datasets used for the validation and calibration of DayCent, including their sources, is provided in Section 7 "Documentation of Validation Datasets for Each PC/CFG/SOC combination" of the MVR. These datasets encompass the project practice categories (PCs) and the project domain, as defined in terms of crop functional groups (CFGs), climate zones, and soils in Appendix B of the MVR.

At Agoro Carbon Alliance, we conduct modeling of GHG emissions for all our growers's fields. Our modeling units are at the field-stratum level. The results from these modeling units are aggregated to the grower level, which acts as the quantification unit, and then further to the project level. The baseline schedule of ALM activities for each field, covering at least three years, is determined through a survey conducted by our Grower Success Team (GST). While the baseline scenario is based on the continuation of pre-project ALM practices, with a historical look-back period of at least three years, the project scenario is based on the GST's grower survey for the implementation of adopted practices. This generates a schedule of activities for each field within the quantification unit in the project area.

GHG emission reporting and quantification

The result of the soil sampling will be used for the baseline and project emission quantification by the DayCent model, in addition to using the quantification approach for the definition of N2O and CH4 emissions. The calculation of the GHG emissions will be performed in Agoro Carbon data management Platform or other quantification tool, such as e.g. in Microsoft Excel. The dedicated project teams (Science and GST teams) will be responsible for QA/QC processes of these calculations. Based on the provided GHG emissions values Carbon Carbon team will be responsible for the reporting of the carbon emissions in PDD, updating permanence assessment if needed and submission of all necessary information to the validation and verification by VVB.

Internal auditing and QA/QC

For the soil analysis data reported by the laboratories, Agoro Carbon will conduct additional QA/QC to identify potential anomalous values and deal with them accordingly. For each sampled field, the distribution of laboratory data will be compared against expected distributions based on existing datasets from comparable fields, POLARIS, or SSURGO, in that order of priority. Should a given sample fall outside the 95% confidence interval of that distribution, a review will be triggered whereby sample collection metadata and field management data will be assessed to determine if there is a plausible explanation for the anomalously high value. If there is, this explanation will be provided at verification. If no explanation is satisfactory, these values and points will be removed so as to maintain a conservative emissions removal estimate.

The soil sampling bodies we work with calibrate their tools based on their own internal SOPs. These SOPs, which have been internally validated by our team of agronomist include hand augers, soil probes, and soil corers, each calibrated to ensure precise measurement of soil parameters.

For the data reported by the farmers the data will undergo QA/QC processes as determined in the sections 5.1. and 5.2 for each parameter. In addition, the members of the GST team will conduct the QA/QC process on the primary data input based on the four-eyes principles, where the data will be controlled for data gaps, outliers, inconsistencies and missing supporting evidence. Any open issues identified will be addressed by the GST team in line with the applied methodology.

The calculation of GHG emissions for the PDD will be conducted by the Agoro Carbon team, conducting also the QA/QC of the calculations and plausibility check following four eyes principle. For the QA/QC of project practices implementation, the GST team in addition will conduct annual monitoring follow-up based on the producer's implementation plan and data collection to track progress and adjust implementation plans as needed.

<u>The procedures for handling non-conformances with the validated monitoring plan.</u>

Procedure for handling internal auditing and non-conformities and providing internal quality assurance are designed to identify and remedy any non-conformities with the validated monitoring plan.

In its own work according to monitoring plan the teams involved in the monitoring process are guided by a range of internal standard operating procedures :

- Soil Carbon Sampling Protocol
- Agoro Lab Testing Protocol
- Protocol for Measuring Soil Organic Carbon Stock in the US Project Area

Collection of reliable primary data: The responsibilities of all staff members as well as the importance of certain field activities are defined in the Agoro team in order to ensure that reliable results are produced. The company personnel, including team members which conduct the collection of monitored data on the grower side, is trained in the relevant tasks to guarantee correct and complete data and information collection and analysis, needed for the monitoring purposes.

Farmers enrolled in the Program are supported by dedicated members from our GST team to ensure that the monitoring plan is correctly followed, and data collection is performed according to the required schedule and that project practices are implemented. Grower Success Onboarding Agronomist leads the monitoring data collection needed from the grower. After data collection, a data specialist uploads, formats, and cleans the data in an Agoro Platform system. Both Agronomist and Data specialists review the data against existing protocols to ensure the accuracy and completeness of the data.

The data on the field geographical boundaries are also analyzed to remove any duplicated fields and field boundary overlaps, and to remove areas such as wetlands, ponds, roads, trees, buildings and other non-eligible areas from the fields which are not eligible for crediting based on other data sources, such as satellite imagery, land cover maps, and governmental GIS data sources.

During the review and processing of collected monitored data, inconsistent, seemingly erroneous, and/or otherwise insufficient data will be investigated. If any data gaps or other irregularities are discovered in the data collection process, these will be discussed in the team and appropriate corrective actions will be elaborated and implemented, to correspond to the type of the errors/irregularities identified to resolve the issues.

In the process of data analysis and calculation of baseline, project, leakage emissions, as well as calculation of emission reductions and removals, all main analysis and calculations processes are subject to additional quality check conducted by another team member, to assure four eyes principle in the review. In case of any non-conformances with validated monitoring plan discovered, such non-conformities discovered will be discussed, the corrective actions needed to resolve non-conformities will be identified in the team calls and allocated to specific team members for correction/mitigation actions. These corrective actions will be mapped in the project management software in order to assign responsible team members and to track progress with the resolution of such actions.

The Monitoring Report for the project and supporting documentation will be subject to internal quality check by all members of the carbon team, before sharing the documentation with VVB. In case of any non-conformities identified in the reporting, relevant team members from other teams will be consulted and corrective actions will be identified and implemented.

Baseline re-evaluation

As required in VM0042 v2.0 and according to the VCS requirements, Agoro Carbon will re-evaluate the baseline schedule of activities every 10 years in the project period to assess whether the commercial crops simulated in the baseline are in continued production in regions in which project instances are located. Agoro Carbon will perform these comparisons at the state level, similar to how it performs its common practice assessments. Using production data from USDA NASS and the Cropland Data Layer from the 5 years prior–or equivalent data sources if these are replaced in future–Agoro Carbon will assess the average proportion of agricultural hectares within the state dedicated to producing the crops simulated in the baseline schedule of activities. Should that proportion have decreased substantially as compared to a similar assessment for t0, Agoro Carbon will consider that decrease as evidence that production has substantially declined and that the baseline commercial crops should be modified per the procedures outlined in VM0042 v2.0 or future versions of VM0042 at the point of re-evaluation.

Benefit Permeance

The contract Agoro Carbon Alliance provides to growers is for ten years. The contract length is ten years for two main reasons. First and foremost, growers are reluctant to enter into a contract for longer than ten years as it limits their options and flexibility. Second, in most circumstances, the rate of soil carbon sequestration will slow after ten years, and a different business model is needed in order for the project to remain profitable.

The Agoro Carbon Program is intentional in its design to reduce behavioral risk. The project is designed around quality acres, grower and farmer agronomic advisory and financial de risking, all of which are key to our efforts to reduce the non-permanency risk associated with practice reversal. The effectiveness of regenerative agricultural practices to permanently sequester SOC at scale is dependent on farmers and farmers implementing operational changes year after year in dynamic and often challenging economic landscapes. The carbon payments received that help to more fully pay for the suite of ecosystem services derived from agricultural land, as well as the ability to attain trusted information, helps ensure practices are implemented successfully without reversal.

Evidence generally shows that growers will continue implementing regenerative practices once they are shown to be effective, eventually eliminating the need for incentives.. Regardless, Agoro Carbon Alliance has additional mitigations to address the permanence of issued credits through approaches below.

Renewal of the contract

While the initial contract term is for ten years, it has the ability to renew automatically for another ten years, unless a 6-months notice is given by either party. Alternative monitoring techniques, such as proximal or remote sensing, may be utilized as new approaches are vetted.. At this point, the program is evaluating various methods and awaiting further guidance and requirements from Verra before committing to a specific monitoring approach.

Storage payment mechanism

Storage contracts will be designed to keep growers engaged in agricultural practices to maintain carbon in their soils. While the primary ten-year contract is designed to incentivize maximum practice implementation, the storage mechanism will be focused on identifying the key best practices that will maintain soil carbon. These practices will be different for different growers based on their soil conditions and environment. This contract is targeted to growers that have plateaued in anticipated soil carbon sequestration. . Just as in the contract renewal, alternative monitoring techniques may be utilized pending Agoro Carbon's review of methods and updates from Verra.

Canceled Contracts

While we would like all growers to remain engaged with Agoro Carbon Alliance for the entire project lifetime, we know that some growers may no longer want to remain under any contract. The original contract the grower signed allows Agoro Carbon to continue to monitor the implemented acres according to the requirements of the methodology. If growers do not want to renew their contract or enter into a storage contract, Agoro Carbon Alliance still has the opportunity to monitor the implemented fields. This will ensure the project can confidently report the permanence of all carbon stocks for the project's lifetime. This monitoring will be done via a combination of site visits, aerial satellite imagery, and conversations with the farmers themselves.

APPENDIX 1: COMMERCIALLY SENSITIVE INFORMATION

Use the table below to describe the commercially sensitive information included in the project description to be excluded in the public version.

Section	Information	Justification

APPENDIX 2: HISTORICAL DATA

Minimum Specification on ALM Practices in Each Geographic Area. Data is based on initial grower baseline data and irrigation data is based on the cited sources. Further detail on baseline grower data can be found at the end of this appendix.

Colorado

ALM Practice	Qualitative	Quantitative	Baseline and Yield per acre	Continuation in Project Scenario
Crop Planting and Harvesting	• Crop type(s)	• Planting date • Harvest date • Yield	• Corn: 66 -70 Bu • Millet: 0.8 -1 tons • Oats: 1.3 – 3.3 tons • Sorghum: 1.6 – 1.8 tons • Spring Wheat: 0.5 – 1 tons • Sunflower: 500 – 700 Lbs • Triticale (hay): 0.5 – 1.2 tons • Winter Wheat: 30 – 80 Bu	Yes – Only limitation is if crop cannot can be modelled
Nitrogen Fertilizer Application	• Synthetic (Y/N) • Manure (Y/N)	• Lb N/acre	• Synthetic (Y) – 36 to 100 lbN/acre on applied crops • Manure (Y) – 192 -240 lbN/acre on applied crops	Yes- with an emphasis on reducing total N
Tillage and/or residue Management	• Tillage (Y/N) • Crop residue removal (Y/N)	• Depth of tillage (where applicable) • Frequency of tillage • Percent of soil area disturbed • Percent of crop residue removed	• Field Cultivator or disc • mixing efficiency ranges from 0.58 to 0.30 • 0 to 100% residue removal	Decrease or cessation of tillage. Crop residue removal is discouraged
Water Management/ Irrigation	• Irrigation (Y/N • Flooding (Y/N)	• Irrigation rate	• 0 to 59 in/acres[2]	Yes, but Flooding will be discouraged
Grazing Practices	• Grazing (Y/N)	• Animal Stocking rate	NA	Will be allowed

[2] https://extension.colostate.edu/topic-areas/agriculture/seasonal-water-needs-and-opportunities-for-limited-irrigation-for-colorado-crops-4-718/

	• Animal Type (where applicable) • Harvesting/mowing (Y/N)	• Frequency of harvest		
Liming	• Application of calcitic limestone or dolomite	• Calcitic limestone or dolomite application rate	• None	• Will be allowed

Idaho

ALM Practice	Qualitative	Quantitative	Baseline and Yield per acre	Continuation in Project Scenario
Crop Planting and Harvesting	• Crop type(s)	• Planting date • Harvest date • Yield	• Alfalfa: 5.6 – 6.8 tons • Barley: 122 – 153 Bu • Bluegrass: 563 – 930 Lbs • Canola: 531 – 587 Lbs • Corn: 180 – 205 Bu • Mustard: 400 – 1800 Lbs • Peas: 700 – 1550 Lbs • Potato: 20 – 36 tons • Safflower: 700 – 2000 Lbs • Spring Wheat: 30 – 35 Lbs • Tall Fescue: 800 – 1000 Lbs • Timothy: 850 – 1000 Bu • Triticale: 11 – 11.8 Tons • Winter Wheat: 25 – 135 Bu	Yes – Only limitation is if crop cannot can be modelled
Nitrogen Fertilizer Application	• Synthetic (Y/N) • Manure (Y/N)	• Lb N/acre	• Synthetic (Y) – 5 to 560 lbN/acre on applied crops • Manure (N)	Yes- with an emphasis on reducing total N
Tillage and/or residue Management	• Tillage (Y/N) • Crop residue removal (Y/N)	• Depth of tillage (where applicable) • Frequency of tillage • Percent of soil area disturbed • Percent of crop residue removed	• Field Cultivator, chisel plow or disc • mixing efficiency ranges from 0.25 to 0.53 • 0 to 100% residue removal	Decrease or cessation of tillage. Crop residue removal is discouraged

Water Management/ Irrigation	• Irrigation (Y/N • Flooding (Y/N)	• Irrigation rate	0 – 47 in/acre[3]	Yes, but Flooding will be discouraged
Grazing Practices	• Grazing (Y/N) • Animal Type (where applicable) • Harvesting/mowing (Y/N)	• Animal Stocking rate • Frequency of harvest	NA	Will be allowed
Liming	• Application of calcitic limestone or dolomite	• Calcitic limestone or dolomite application rate	• None	• Will be allowed

Illinois

ALM Practice	Qualitative	Quantitative	Baseline and Yield per acre	Continuation in Project Scenario
Crop Planting and Harvesting	• Crop type(s)	• Planting date • Harvest date • Yield	• Corn: 135 – 266 Bu • Soybean: 34 – 81 Bu	Yes – Only limitation is if crop cannot can be modelled
Nitrogen Fertilizer Application	• Synthetic (Y/N) • Manure (Y/N)	• Lb N/acre	• Synthetic (Y) – 9 to 209 lbN/acre on applied crops • Manure (N)	Yes- with an emphasis on reducing total N
Tillage and/or residue Management	• Tillage (Y/N) • Crop residue removal (Y/N)	• Depth of tillage (where applicable) • Frequency of tillage • Percent of soil area disturbed • Percent of crop residue removed	• Field Cultivator, chisel plow or disc • mixing efficiency ranges from 0.40 to 0.41 • 0 to 100% residue removal	Decrease or cessation of tillage. Crop residue removal is discouraged
Water Management/ Irrigation	• Irrigation (Y/N • Flooding (Y/N)	• Irrigation rate	Negligible	Yes, but Flooding will be discouraged

[3] https://idwr.idaho.gov/wp-content/uploads/sites/2/publications/1983-MISC-Est-Consumptive-Use-08-1983.pdf

Grazing Practices	• Grazing (Y/N) • Animal Type (where applicable) • Harvesting/mowing (Y/N)	• Animal Stocking rate • Frequency of harvest	• Grazing (Y) • Cattle (0.4/acre) • Only used for grazing litter	Yes the practice will continue to be allowed
Liming	• Application of calcitic limestone or dolomite	• Calcitic limestone or dolomite application rate	• None	• Will be allowed

Indiana

ALM Practice	Qualitative	Quantitative	Baseline and Yield per acre	Continuation in Project Scenario
Crop Planting and Harvesting	• Crop type(s)	• Planting date • Harvest date • Yield	• Corn: 50 – 225 Bu • Soybean: 42 – 175 Bu	Yes – Only limitation is if crop cannot can be modelled
Nitrogen Fertilizer Application	• Synthetic (Y/N) • Manure (Y/N)	• Lb N/acre	• Synthetic (Y) – 5 to 560 lbN/acre on applied crops • Manure (N)	Yes- with an emphasis on reducing total N
Tillage and/or residue Management	• Tillage (Y/N) • Crop residue removal (Y/N)	• Depth of tillage (where applicable) • Frequency of tillage • Percent of soil area disturbed • Percent of crop residue removed	• Field Cultivator, chisel plow or disc • mixing efficiency ranges from 0.25 to 0.53 • 0 to 100% residue removal	Decrease or cessation of tillage. Crop residue removal is discouraged
Water Management/ Irrigation	• Irrigation (Y/N • Flooding (Y/N)	• Irrigation rate	0 – 15 in/acre[4]	Yes, but Flooding will be discouraged
Grazing Practices	• Grazing (Y/N) • Animal Type (where applicable)	• Animal Stocking rate • Frequency of harvest	NA	Will be allowed

[4] https://journals.ametsoc.org/view/journals/apme/59/12/jamc-d-20-0024.1.pdf

	• Harvesting/mowing (Y/N)			
Liming	• Application of calcitic limestone or dolomite	• Calcitic limestone or dolomite application rate	• None	• Will be allowed

Minnesota

ALM Practice	Qualitative	Quantitative	Baseline and Yield per acre	Continuation in Project Scenario
Crop Planting and Harvesting	• Crop type(s)	• Planting date • Harvest date • Yield	• Alfalfa: 2.6 – 3 Tons • Corn: 105.6 – 239.3 Bu • Dry Bean: 1005 – 2511 Lbs • Edible Bean: 1750 – 1843.2 Lbs • Oats: 20 – 52.8 Bu • Potato: 18400 – 37400 Lbs • Rye: 49 – 71 Bu • Soybean: 10 – 83 Bu • Spring Wheat: 23 – 58.7 Bu • Sugar Beets: 25 – 35.1 Tons • Timothy: 0.5 – 2.5 Tons	Yes – Only limitation is if crop cannot can be modelled
Nitrogen Fertilizer Application	• Synthetic (Y/N) • Manure (Y/N)	• Lb N/acre	• Synthetic (Y) – 0 to 138 lbN/acre on applied crops • Manure (N)	Yes- with an emphasis on reducing total N
Tillage and/or residue Management	• Tillage (Y/N) • Crop residue removal (Y/N)	• Depth of tillage (where applicable) • Frequency of tillage • Percent of soil area disturbed • Percent of crop residue removed	• Field Cultivator, chisel plow or disc • mixing efficiency ranges from 0.25 to 0.3 • 0 to 100% residue removal	Decrease or cessation of tillage. Crop residue removal is discouraged

Water Management/ Irrigation	• Irrigation (Y/N • Flooding (Y/N)	• Irrigation rate	0 – 17 in/acre[5,6]	Yes, but Flooding will be discouraged
Grazing Practices	• Grazing (Y/N) • Animal Type (where applicable) • Harvesting/mowing (Y/N)	• Animal Stocking rate • Frequency of harvest	NA	Will be allowed
Liming	• Application of calcitic limestone or dolomite	• Calcitic limestone or dolomite application rate	• None	• Will be allowed

Nebraska

ALM Practice	Qualitative	Quantitative	Baseline and Yield per acre	Continuation in Project Scenario
Crop Planting and Harvesting	• Crop type(s)	• Planting date • Harvest date • Yield	• Alfalfa: 2.5 – 7.5 Tons • Corn: 107– 264 Bu • Millet: 15 – 24 Bu • Sorghum: 40 – 86 Bu • Sorghum-Sudan: 5 – 8 Tons • Soybean: 27.4– 90.6 Bu	Yes – Only limitation is if crop cannot can be modelled
Nitrogen Fertilizer Application	• Synthetic (Y/N) • Manure (Y/N)	• Lb N/acre	• Synthetic (Y) – 20 to 480 lbN/acre on applied crops • Manure (N)	Yes- with an emphasis on reducing total N
Tillage and/or residue Management	• Tillage (Y/N) • Crop residue removal (Y/N)	• Depth of tillage (where applicable) • Frequency of tillage • Percent of soil area disturbed • Percent of crop residue removed	• Field Cultivator, chisel plow, strip till, or disc • mixing efficiency ranges from 0.3 to 0.85 • 0 to 100% residue removal	Decrease or cessation of tillage. Crop residue removal is discouraged

[5] https://extension.umn.edu/growing-forages/alfalfa-during-drought

[6] https://statesummaries.ncics.org/chapter/mn/#:~:text=Annual%20average%20precipitation%2C%20including%20rainfall,season%20(May%20through%20September)

Water Management/ Irrigation	• Irrigation (Y/N • Flooding (Y/N)	• Irrigation rate	0 – 36 in/acre[7]	Yes, but Flooding will be discouraged
Grazing Practices	• Grazing (Y/N) • Animal Type (where applicable) • Harvesting/mowing (Y/N)	• Animal Stocking rate • Frequency of harvest	NA	Will be allowed
Liming	• Application of calcitic limestone or dolomite	• Calcitic limestone or dolomite application rate	• None	• Will be allowed

Oregon

ALM Practice	Qualitative	Quantitative	Baseline and Yield per acre	Continuation in Project Scenario
Crop Planting and Harvesting	• Crop type(s)	• Planting date • Harvest date • Yield	• Alfalfa: 0.9 – 1.2 Tons • Winter Wheat: 18 – 55 Bu	Yes – Only limitation is if crop cannot can be modelled
Nitrogen Fertilizer Application	• Synthetic (Y/N) • Manure (Y/N)	• Lb N/acre	• Synthetic (Y) – 0 to 24 lbN/acre on applied crops • Manure (N)	Yes- with an emphasis on reducing total N
Tillage and/or residue Management	• Tillage (Y/N) • Crop residue removal (Y/N)	• Depth of tillage (where applicable) • Frequency of tillage • Percent of soil area disturbed • Percent of crop residue removed	• Field Cultivator, chisel plow, Rod Weeder, or disc • mixing efficiency ranges from 0.3 to 0.36 • 0 to 100% residue removal	Decrease or cessation of tillage. Crop residue removal is discouraged

[7] https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=2196&context=extensionhist

Water Management/ Irrigation	• Irrigation (Y/N • Flooding (Y/N)	• Irrigation rate	0 – 37 in/acre[8,9]	Yes, but Flooding will be discouraged
Grazing Practices	• Grazing (Y/N) • Animal Type (where applicable) • Harvesting/mowing (Y/N)	• Animal Stocking rate • Frequency of harvest	NA	Will be allowed
Liming	• Application of calcitic limestone or dolomite	• Calcitic limestone or dolomite application rate	• None	• Will be allowed

South Dakota

ALM Practice	Qualitative	Quantitative	Baseline and Yield per acre	Continuation in Project Scenario
Crop Planting and Harvesting	• Crop type(s)	• Planting date • Harvest date • Yield	• Corn: 138 – 244 Bu • Soybean: 44 – 72.3 Bu	Yes – Only limitation is if crop cannot can be modelled
Nitrogen Fertilizer Application	• Synthetic (Y/N) • Manure (Y/N)	• Lb N/acre	• Synthetic (Y) – 7 to 170 lbN/acre on applied crops • Manure (N)	Yes- with an emphasis on reducing total N
Tillage and/or residue Management	• Tillage (Y/N) • Crop residue removal (Y/N)	• Depth of tillage (where applicable) • Frequency of tillage • Percent of soil area disturbed • Percent of crop residue removed	• Field Cultivator, chisel plow, or disc • mixing efficiency ranges from 0.53 to 0.66 • 0 to 100% residue removal	Decrease or cessation of tillage. Crop residue removal is discouraged

[8] https://www.oregon.gov/owrd/programs/Planning/IWRS/Documents/Appendix_F_Comparison_of_ET_methods_for_Klamath_basin.pdf

[9] https://www.usbr.gov/pn/agrimet//etsummary.html?station=bano&year=2022

Water Management/ Irrigation	• Irrigation (Y/N • Flooding (Y/N)	• Irrigation rate	0 – 28 in/acre[10]	Yes, but Flooding will be discouraged
Grazing Practices	• Grazing (Y/N) • Animal Type (where applicable) • Harvesting/mowing (Y/N)	• Animal Stocking rate • Frequency of harvest	NA	Will be allowed
Liming	• Application of calcitic limestone or dolomite	• Calcitic limestone or dolomite application rate	• None	• Will be allowed

Texas

ALM Practice	Qualitative	Quantitative	Baseline and Yield per acre	Continuation in Project Scenario
Crop Planting and Harvesting	• Crop type(s)	• Planting date • Harvest date • Yield	• Cotton: 12 – 850 Lbs • Sorghum-Sudan: .5 -1.5 tons • Winter Wheat: 25 – 30 Bu	Yes – Only limitation is if crop cannot can be modelled
Nitrogen Fertilizer Application	• Synthetic (Y/N) • Manure (Y/N)	• Lb N/acre	• Synthetic (Y) – 9 to 72 lbN/acre on applied crops • Manure (N)	Yes- with an emphasis on reducing total N
Tillage and/or residue Management	• Tillage (Y/N) • Crop residue removal (Y/N)	• Depth of tillage (where applicable) • Frequency of tillage • Percent of soil area disturbed • Percent of crop residue removed	• Field Cultivator, chisel plow, or disc • mixing efficiency ranges from 0.29 to 0.85 • 0 to 100% residue removal	Decrease or cessation of tillage. Crop residue removal is discouraged
Water Management/ Irrigation	• Irrigation (Y/N • Flooding (Y/N)	• Irrigation rate	0 – 66 in/acre[11]	Yes, but Flooding will be discouraged

[10] https://openprairie.sdstate.edu/cgi/viewcontent.cgi?article=1432&context=extension_circ

[11] https://oaktrust.library.tamu.edu/server/api/core/bitstreams/341b6e23-122c-4eef-8083-3a1ae49a5876/content

Grazing Practices	• Grazing (Y/N) • Animal Type (where applicable) • Harvesting/mowing (Y/N)	• Animal Stocking rate • Frequency of harvest	NA	Will be allowed
Liming	• Application of calcitic limestone or dolomite	• Calcitic limestone or dolomite application rate	• None	• Will be allowed

Washington

ALM Practice	Qualitative	Quantitative	Baseline and Yield per acre	Continuation in Project Scenario
Crop Planting and Harvesting	• Crop type(s)	• Planting date • Harvest date • Yield	• Alfalfa: 0.9 – 6.5 Tons • Asparagus: 5k – 6k Lbs • Barley: 5 – 104 Bu • Bluegrass: 139 – 2495 Lbs • Buckwheat: 2100 – 2562 Lbs • Canola: 587 – 3000 Lbs • Chickpeas: 1000 – 1794 Bu • Corn: 7 – 247.7 Bu • Lentils: 1000 – 1652 Lbs • Oats: 5 – 29 Bu • Peas: 810 – 5890 Lbs • Potato: 30 – 35 Tons • Spring Wheat: 64 – 2250 Lbs • Sugar Beets: 2000 – 3500 Lbs • Sweet Corn: 7 – 10.5 Tons • Tall Fescue: 900 – 1140 Bu • Timothy: 0.2 – 3.5 Tons • Triticale: 0.5 – 2.7 Tons • Winter Wheat: 9.8 – 130 Bu	Yes – Only limitation is if crop cannot can be modelled
Nitrogen Fertilizer Application	• Synthetic (Y/N) • Manure (Y/N)	• Lb N/acre	• Synthetic (Y) – 10 to 700 lbN/acre on applied crops • Manure (N)	Yes- with an emphasis on reducing total N

Tillage and/or residue Management	• Tillage (Y/N) • Crop residue removal (Y/N)	• Depth of tillage (where applicable) • Frequency of tillage • Percent of soil area disturbed • Percent of crop residue removed	• Field Cultivator, chisel plow, or disc • mixing efficiency ranges from 0.01 to 0.59 • 0 to 100% residue removal	Decrease or cessation of tillage. Crop residue removal is discouraged
Water Management/ Irrigation	• Irrigation (Y/N • Flooding (Y/N)	• Irrigation rate	0 – 55 in/acre[12]	Yes, but Flooding will be discouraged
Grazing Practices	• Grazing (Y/N) • Animal Type (where applicable) • Harvesting/mowing (Y/N)	• Animal Stocking rate • Frequency of harvest	• Grazing (Y) • Cattle (0.03 head per acre) • Only used for grazing litter	Yes the practice will continue to be allowed
Liming	• Application of calcitic limestone or dolomite	• Calcitic limestone or dolomite application rate	• None	• Will be allowed

Wisconsin

ALM Practice	Qualitative	Quantitative	Baseline and Yield per acre	Continuation in Project Scenario
Crop Planting and Harvesting	• Crop type(s)	• Planting date • Harvest date • Yield	• Alfalfa: 1 – 3.2 Tons • Corn: 159 – 239 Bu • Sorghum: 159 – 219 Bu	Yes – Only limitation is if crop cannot can be modelled
Nitrogen Fertilizer Application	• Synthetic (Y/N) • Manure (Y/N)	• Lb N/acre	• Synthetic (Y) – 50 to 192 lbN/acre on applied crops • Manure (N)	Yes- with an emphasis on reducing total N
Tillage and/or residue Management	• Tillage (Y/N) • Crop residue removal (Y/N)	• Depth of tillage (where applicable) • Frequency of tillage • Percent of soil area disturbed	• Field Cultivator, chisel plow, or disc • mixing efficiency ranges from 0.3 to 0.45 • 0 to 100% residue removal	Decrease or cessation of tillage.

[12] http://irrigation.wsu.edu/Content/Calculators/Historic/AllCrops1Station.php

		• Percent of crop residue removed		Crop residue removal is discouraged
Water Management/ Irrigation	• Irrigation (Y/N • Flooding (Y/N)	• Irrigation rate	Negligible	Yes, but Flooding will be discouraged
Grazing Practices	• Grazing (Y/N) • Animal Type (where applicable) • Harvesting/mowing (Y/N)	• Animal Stocking rate • Frequency of harvest	NA	Will be allowed
Liming	• Application of calcitic limestone or dolomite	• Calcitic limestone or dolomite application rate	• None	• Will be allowed

State	Crop	Earliest Planting Date	Latest Planting Date	Average days to harvest	Min Days to Harvest	Max Days to Harvest	Harvest Type (Most Common)	Average Yield/Acre	Lowest Yield	Highest Yield	Yield Unit	Tillage Activity (Most Common)	Average Mixing Efficiency per event	Synthetic Fert (Most Common)	Average N lbs/Acre	MinimumN lbs/Acre	Maximum N lbs/Acre	Average P lbs/ Acre	Min P lbs/ Acre	Max P lbs/ Acre	Manure (Most common)	Average Application Amount	Average N Lbs/acre	Minimun N Lbs/acre	Maximum N Lbs/acre	P/acre	Cover crop (most common by state)
California	Alfalfa	04/06	09/01	908	47	2180	Hay	3.2	0.8	7.5	Tons	Disc	0.4591	Other	32.0	32.0	32.0	40	40	40							Triticale,Austrian Winter Pea
Colorado	Corn	06/01	07/22	148	98	157	Combine	66.0	60.0	70.0	Bu	Disc	0.5750	Other	44.0	36.0	100.0	0	0	0							Peas,Sorghun Sundagrass,Brassica, Sunn Hemp
Colorado	Millet	05/06	07/15	117	61	154	Combine	0.9	0.8	1.0	Tons	Field Cultivator	0.4158	Other	43.6	40.0	58.0	0	0	0	Beef (dirt lot)-Solid manure	8	192	192	192	0	Peas,Sorghun Sundagrass,Brassica, Sunn Hemp
Colorado	Oats	04/01	04/01	101	100	102	Hay	2.3	1.3	3.3	Tons																Peas,Sorghun Sundagrass,Brassica, Sunn Hemp
Colorado	Sorghum	07/17	07/22	57	50	63	Hay	1.8	1.6	1.9	Tons	Field Cultivator	0.3000														Peas,Sorghun Sundagrass,Brassica, Sunn Hemp
Colorado	Spring Wheat	04/09	04/09	83	83	83	Hay	1.0	1.0	1.0	Tons	Field Cultivator	0.3000														Peas,Sorghun Sundagrass,Brassica, Sunn Hemp
Colorado	Sunflower	05/01	05/02	89	88	89	Combine	700.0	700.0	700.0	Lbs	Disc	0.5100								Beef (dirt lot)-Solid manure	10	240	240	240	0	Peas,Sorghun Sundagrass,Brassica, Sunn Hemp
Colorado	Triticale	04/04	12/09	178	170	185	Cut Silage	1.2	1.2	1.2	Tons			Other	70.0	70.0	70.0	0	0	0							Peas,Sorghun Sundagrass,Brassica, Sunn Hemp
Colorado	Winter Wheat	09/01	10/02	309	122	411	Combine	55.0	30.0	80.0	Bu	Field Cultivator	0.4974	Other	48.7	40.0	83.0	0	0	0	Beef (dirt lot)-Solid manure	8	192	192	192	0	Peas,Sorghun Sundagrass,Brassica, Sunn Hemp
Idaho	Alfalfa	04/01	04/15	1661	833	2304	Hay	6.2	5.9	6.8	Tons			Other	22.0	22.0	22.0	104	104	104							Brassica,Millet,Common Vetch
Idaho	Barley	04/01	10/15	128	108	295	Combine	133.4	122.0	153.0	Bu	Chisel Plow	0.4511	Other	103.6	100.0	220.0	1	0	40							Brassica,Millet,Common Vetch
Idaho	Bluegrass	10/01	10/01	489	306	671	Combine	746.5	563.0	930.0	Lbs			Other	220.0	220.0	220.0	34	34	34							Brassica,Millet,Common Vetch
Idaho	Canola	04/30	04/30	136	136	136	Combine	587.0	587.0	587.0	Lbs	Field Cultivator	0.2500	Other	200.0	200.0	200.0	25	25	25							Brassica,Millet,Common Vetch
Idaho	Corn	04/30	05/01	151	127	158	Combine	202.5	200.0	205.0	Bu	Disc	0.4490	Other	198.3	120.0	240.0	43	40	50							Brassica,Millet,Common Vetch
Idaho	Mustard	04/01	09/01	161	122	335	Combine	975.0	400.0	1800.0	Lbs	Chisel Plow	0.4286	Other	122.1	5.0	185.0	35	15	50							Brassica,Millet,Common Vetch
Idaho	Peas	04/01	09/15	188	122	320	Combine	1033.3	700.0	1550.0	Lbs	Field Cultivator	0.3000	Other	23.3	5.0	60.0	14	10	16							Brassica,Millet,Common Vetch
Idaho	Potato	04/15	05/05	150	136	176	Potato Harvester	28.1	20.0	36.0	Tons	Disc	0.5569	Other	282.9	100.0	560.0	1	0	50							Brassica,Millet,Common Vetch
Idaho	Safflower	04/01	04/25	144	139	153	Combine	1383.3	700.0	2000.0	Lbs	Field Cultivator	0.2750	Other	50.0	50.0	50.0	10	10	10							Brassica,Millet,Common Vetch
Idaho	Spring Wheat	04/10	09/10	131	120	340	Combine	35.0	35.0	35.0	Lbs	Harrow	0.4552	Other	190.9	35.0	200.0	0	0	10							Brassica,Millet,Common Vetch
Idaho	Tall Fescue	08/01	08/10	431	334	709	Combine	1000.0	1000.0	1000.0	Lbs	Cultipacker	0.4167	Other	100.0	100.0	100.0	20	20	20							Brassica,Millet,Common Vetch
Idaho	Timothy	04/25	04/25	132	129	133	Combine	1000.0	1000.0	1000.0	Bu	Disc	0.5250	Other	100.0	100.0	100.0	20	20	20							Brassica,Millet,Common Vetch
Idaho	Triticale	04/10	04/10	142	139	143	Hay	11.8	11.7	11.8	Tons	Chisel Plow	0.3000	Other	56.0	34.0	100.0	0	0	0							Brassica,Millet,Common Vetch
Idaho	Winter Wheat	09/01	10/17	326	283	382	Combine	56.9	25.0	135.0	Bu	Field Cultivator	0.4299	Other	134.6	35.0	420.0	10	0	30							Brassica,Millet,Common Vetch
Illinois	Corn	04/03	05/24	178	122	224	Combine	202.1	135.0	266.0	Bu	Field Cultivator	0.4065	Other	183.2	164.0	209.0	14	0	42							Wheat
Illinois	Soybean	04/03	05/24	172	129	209	Combine	60.2	34.0	81.0	Bu	Field Cultivator	0.3957	Other	9.0	9.0	9.0	42	42	42							Wheat
Indiana	Corn	05/01	05/29	180	149	506	Combine	179.2	50.0	225.0	Bu	Disc	0.6597	Other	168.1	0.0	400.0	0	0	0							Cereal Rye
Indiana	Soybean	05/01	06/08	168	118	196	Combine	58.4	42.0	175.0	Bu	Disc	0.5881	Ammonium Sulphate	36.2	0.0	200.0	25	0	31							Cereal Rye
Iowa	Alfalfa	04/10	09/06	170	21	415	Hay	2.3	1.5	3.2	Tons																Annual Rye
Iowa	Corn	03/23	07/13	168	60	544	Combine	193.8	62.0	259.0	Bu	Field Cultivator	0.3449	Other	184.6	0.0	440.0	47	0	180	Broiler (litter from house)-Solid manure	2111.344643	137.0338661	0.008	450	0	Annual Rye
Iowa	Soybean	04/07	07/14	160	26	536	Combine	55.5	0.0	88.5	Bu	Field Cultivator	0.3589	Other	23.2	0.0	245.0	33	0	100	Broiler (litter from house)-Solid manure	2318.166667	179.1633333	29.48	225	0	Annual Rye
Iowa	Winter Wheat	09/17	10/30	293	254	333	Combine	48.4	38.7	75.6	Bu	Chisel Plow	0.3000	Other	90.0	90.0	90.0	0	0	0							Annual Rye
Kansas	Corn	04/10	06/01	154	115	184	Combine	131.6	32.4	242.0	Bu	Field Cultivator	0.4725	Other	152.5	49.0	304.0	20	0	40	Broiler (litter from house)-Solid manure	2	150	150	150	0	Rye
Kansas	Oats	02/24	02/24	146	146	146	Cut Silage	7.5	7.5	7.5	Tons										Broiler (litter from house)-Solid manure	2	150	150	150	0	Rye
Kansas	Rye	10/10	10/10	258	253	264	Combine	35.0	35.0	35.0	Bu	Disc	0.5115	Other	162.5	130.0	260.0	0	0	0							Rye
Kansas	Sorghum	05/01	06/20	151	103	200	Combine	77.6	30.0	119.0	Bu	Field Cultivator	0.3917	Other	149.3	125.0	174.0	13	0	27							Rye
Kansas	Soybean	05/01	06/25	142	117	178	Combine	27.8	0.0	90.0	Bu	Chisel Plow	0.4467	Other	174.0	174.0	174.0	0	0	0	Broiler (litter from house)-Solid manure	2	150	150	150	0	Rye
Kansas	Winter Wheat	05/01	11/06	249	203	527	Combine	47.7	0.0	90.0	Bu	Disc	0.4862	Other	127.0	90.0	306.0	1	0	40	Broiler (litter from house)-Solid manure			0	0		Rye
Minnesota	Alfalfa	05/30	05/30	357	113	844	Hay	2.8	2.6	3.0	Tons	Vertical Tillage (high intensity)	0.3000	MAP	13.5	9.6	14.5	36	26	39							Winter Rye
Minnesota	Corn	04/15	05/16	173	148	203	Combine	194.4	105.6	239.3	Bu	Field Cultivator	0.3125	Other	163.2	135.0	202.7	17	0	86	Beef (bedded pack barn)-Solid manure			0	0		Winter Rye
Minnesota	Dry Bean	05/22	05/31	130	123	154	Combine	1998.0	1005.0	2511.0	Lbs	Vertical Tillage (high intensity)	0.2667	Other	45.5	41.0	51.0	49	42	55							Winter Rye
Minnesota	Edible Bean	05/29	05/30	156	155	156	Combine	1843.1	1843.0	1843.2	Lbs	Vertical Tillage (high intensity)	0.3000	Other	12.0	12.0	12.0	55	55	55							Winter Rye
Minnesota	Oats	04/10	04/10	101	101	101	Combine	52.8	52.8	52.8	Bu																Winter Rye
Minnesota	Potato	05/17	06/04	124	97	142	Potato Harvester	28841.7	18400.0	37400.0	Lbs	Vertical Tillage (high intensity)	0.3932	Other	73.2	56.0	132.0	162	23	241							Winter Rye
Minnesota	Rye	09/30	10/07	304	299	308	Combine	60.0	49.0	71.0	Bu																Winter Rye
Minnesota	Soybean	04/23	07/05	138	93	190	Combine	42.1	10.0	83.0	Bu	Vertical Tillage (high intensity)	0.2958	Other	9.2	0.0	138.0	35	0	76							Winter Rye
Minnesota	Spring Wheat	04/15	05/15	100	86	118	Combine	41.7	23.0	58.7	Bu	Vertical Tillage (high intensity)	0.3000	Other	61.7	9.6	120.0	37	20	73							Winter Rye
Minnesota	Sugar Beets	04/10	04/10	174	174	174	Potato Harvester	30.1	25.0	35.1	Tons																Winter Rye
Minnesota	Timothy	01/01	01/01	881	516	1247	Hay	2.5	2.5	2.5	Tons																Winter Rye
Missouri	Corn	04/05	06/20	143	92	183	Combine	176.2	40.0	239.9	Bu	Field Cultivator	0.4340	Anhydrous Ammor	165.2	0.0	341.1	2	0	111							Annual Rye
Missouri	Soybean	04/15	06/22	138	108	204	Combine	56.9	37.0	74.0	Bu	Field Cultivator	0.4437	Other	46.9	0.0	208.3	6	0	80							Annual Rye
Montana	Alfalfa	04/06	04/06	85	84	86	Hay	5.0	5.0	5.0	Tons																Brassica
Montana	Barley	03/30	05/31	126	73	149	Combine	29.8	5.0	53.0	Bu	Field Cultivator	0.3000	Other	39.2	35.0	42.0	13	0	21							Brassica
Montana	Lentils	04/01	04/01	131	131	131	Combine	3.0	3.0	3.0	Bu			Other	42.0	42.0	42.0	35	35	35							Brassica
Montana	Mustard	04/15	05/02	111	108	114	Combine	843.0	843.0	843.0	Lbs			Other	49.0	49.0	49.0	21	21	21							Brassica
Montana	Peas	03/28	05/07	83	84	124	Combine	21.0	21.0	21.0	Bu			Other	46.0	42.0	54.0	30	21	35							Brassica
Montana	Spring Wheat	04/02	05/15	130	88	157	Combine	23.0	15.0	31.0	Bu			Other	41.4	35.0	49.0	19	0	21							Brassica
Nebraska	Alfalfa	04/01	01/01	794	182	1310	Hay	5.3	2.5	7.5	Tons	Disc	0.8500								Beef (paved lot)-Solid manure			0	0		Annual Rye
Nebraska	Corn	04/20	05/15	162	135	180	Combine	216.0	107.0	264.0	Bu	Strip-Till	0.3000	Other	207.6	46.0	480.0	5	0	46							Annual Rye
Nebraska	Millet	06/01	06/01	112	92	131	Grazed	24.0	24.0	24.0	Bu			Other	20.0	20.0	20.0	0	0	0	Beef (paved lot)-Solid manure			0	0		Annual Rye
Nebraska	Sorghum	05/20	05/20	135	134	136	Grazed	86.0	86.0	86.0	Bu			Other	20.0	20.0	20.0	0	0	0							Annual Rye
Nebraska	Sorghum-Sudan	06/07	06/07	116	116	116	Mow	8.0	8.0	8.0	Tons	Disc	0.8500														Annual Rye
Nebraska	Soybean	04/19	05/18	149	134	173	Combine	60.8	27.4	90.6	Bu	Vertical Tillage (high intensity)	0.3000	Other	189.0	189.0	189.0	46	46	46							Annual Rye
North Dakota	Alfalfa	05/15	05/15	661	382	1188	Hay	5.0	5.0	5.0	Tons																Annual Rye
North Dakota	Barley	05/31	05/31	98	98	98	Combine	107.0	107.0	107.0	Bu	Field Cultivator	0.3000	Other	7.0	7.0	7.0	25	25	25							Annual Rye
North Dakota	Corn	04/30	06/04	163	145	182	Combine	128.8	88.0	167.0	Bu	Disc	0.5625	Other	84.4	17.0	214.0	22	0	65							Annual Rye
North Dakota	Edible Bean	06/02	06/02	115	115	115	Combine	5106.0	5106.0	5106.0	Lbs	Vertical Tillage (low intensity)	0.2000	Other	1.0	1.0	1.0	10	10	10							Annual Rye
North Dakota	Soybean	05/21	06/12	131	116	159	Combine	42.8	20.0	54.0	Bu	Field Cultivator	0.4000	Other	43.3	1.0	66.0	13	10	20							Annual Rye
North Dakota	Spring Wheat	06/06	06/06	145	145	145	Combine	43.0	43.0	43.0	Bu	Field Cultivator	0.3000	Other	9.0	9.0	9.0	30	30	30							Annual Rye
North Dakota	Sunflower	05/19	06/28	131	115	137	Combine	2209.5	1971.0	2484.0	Lbs	Disc	0.5625	Other	75.0	46.0	105.0	29	20	45							Annual Rye
Ohio	Corn	04/26	05/20	151	125	189	Combine	219.4	104.0	251.0	Bu			Other	237.3	0.0	256.0	5	0	5							
Ohio	Soybean	04/28	07/07	141	115	160	Combine	68.3	25.0	84.5	Bu			Other	48.8	0.0	256.0	1	0	5							
Ohio	Winter Wheat	11/01	11/05	243	240	245	Combine	109.0	93.0	129.0	Bu			Other	100.0	100.0	100.0	0	0	0	Dairy (lagoon)-Liquid effluent			0	0		
Oregon	Alfalfa	04/09	04/09	424	58	789	Hay	1.1	0.9	1.2	Tons																Austrian Winter Pea
Oregon	Winter Wheat	09/01	10/20	296	270	313	Combine	38.0	18.0	55.0	Bu	Rod Weeder	0.3617	Anhydrous Ammor	24.6	24.6	24.6	0	0	0							Austrian Winter Pea
South Dakota	Corn	04/22	06/02	167	155	181	Combine	203.3	138.0	244.0	Bu	Disc	0.6596	Other	139.3	7.0	170.0	92	16	156							
South Dakota	Soybean	04/30	06/07	136	121	153	Combine	56.8	44.0	72.3	Bu	Field Cultivator	0.5327														
Texas	Cotton	05/08	06/22	141	92	166	Cotton Stripper	146.1	12.0	850.0	Lbs	Field Cultivator	0.3351	Other	63.9	44.0	72.0	5	0	22							Wheat
Texas	Sorghum-Sudan	05/20	05/20	133	123	154	Cut Silage	1.0	1.0	1.0	Tons	Disc	0.8500														Wheat

State	Crop	Earliest Planting Date	Latest Planting Date	Average days to harvest	Min Days to Harvest	Max Days to Harvest	Harvest Type (Most Common)	Average Yield/Acre	Lowest Yield	Highest Yield	Yield Unit	Tillage Activity (Most Common)	Average Mixing Efficiency per event	Synthetic Fert (Most Common)	Average N lbs/Acre	MinimumN lbs/Acre	Maximum N lbs/Acre	Average P lbs/ Acre	Min P lbs/ Acre	Max P lbs/ Acre	Manure (Most common)	Average Application Amount	Average N Lbs/acre	Minimun N Lbs/acre	Maximum N Lbs/acre	P/acre	Cover crop (most common by state)
Texas	Winter Wheat	10/15	10/15	202	229	230	Combine	28.0	25.0	30.0	Bu	Chisel Plow	0.2872	Other	40.1	9.0	41.0	5	0	23							Wheat
Washington	Alfalfa	03/09	10/10	469	43	1193	Hay	4.2	0.9	6.5	Tons	Mower	0.2086	Other	118.9	27.6	310.7	63	0	167							Peas
Washington	Asparagus	04/15	04/15	60	60	60	Combine	6000.0	6000.0	6000.0	Bu	Mower	0.0857	Other	226.7	226.7	226.7	162	162	162							Peas
Washington	Barley	03/15	05/14	104	63	163	Combine	60.8	5.0	104.0	Bu	Field Cultivator	0.3735	Other	118.6	28.0	652.2	25	0	111							Peas
Washington	Bluegrass	03/26	11/01	361	132	1029	Combine	950.1	139.0	2495.0	Lbs	Mower	0.2191	Other	167.0	14.8	384.2	24	0	142							Peas
Washington	Buckwheat	06/01	07/16	92	76	113	Combine	2387.3	2100.0	2562.0	Lbs	Vertical Tillage (low intensity)	0.2688	Other	145.4	62.4	330.0	1	0	1							Peas
Washington	Canola	04/12	09/25	259	87	356	Combine	1917.9	587.0	3000.0	Lbs	Harrow	0.2690	Other	57.1	10.1	200.0	4	0	30							Peas
Washington	Chickpeas	04/21	04/21	126	126	126	Combine	1794.0	1794.0	1794.0	Bu																Peas
Washington	Corn	04/15	07/10	146	103	238	Combine	190.5	7.0	247.7	Bu	Vertical Tillage (low intensity)	0.3166	Other	317.3	23.6	634.3	68	0	602							Peas
Washington	Lentils	05/08	07/25	102	34	151	Combine	1427.3	1156.0	1652.0	Lbs	Field Cultivator	0.3000	Other	60.0	30.0	90.0	13	0	25							Peas
Washington	Oats	04/19	05/23	83	37	135	Combine	14.7	5.0	29.0	Bu	Disc	0.5900	Urea	97.5	60.0	140.3	4	0	24							Peas
Washington	Peas	04/06	10/19	159	67	342	Combine	2074.3	810.0	5890.0	Lbs	Vertical Tillage (low intensity)	0.3378	Other	82.2	0.0	321.3	23	0	134							Peas
Washington	Potato	03/15	05/03	157	71	196	Potato Harvester	32.5	30.0	35.0	Tons	Vertical Tillage (low intensity)	0.3187	Other	417.4	145.0	685.6	168	0	305							Peas
Washington	Spring Wheat	02/28	06/05	118	57	156	Combine	1157.0	64.0	2250.0	Lbs	Harrow	0.2601	Other	107.5	20.0	698.6	13	0	293							Peas
Washington	Sugar Beets	04/01	04/01	116	116	116	Combine	3500.0	3500.0	3500.0	Lbs																Peas
Washington	Sweet Corn	03/10	05/24	121	83	163	Combine	9.2	7.0	10.5	Tons	Disc	0.3238	Other	288.3	144.3	611.3		0	0							Peas
Washington	Tall Fescue	05/03	09/30	230	109	293	Combine	1020.0	900.0	1140.0	Bu	Mower	0.0000	Anhydrous Ammon	139.4	139.4	139.4		0	0							Peas
Washington	Timothy	04/01	10/05	475	91	1034	Hay	1.7	0.2	3.5	Tons	Mower	0.2094	Other	108.3	25.0	244.5		0	0							Peas
Washington	Triticale	04/15	10/06	275	51	345	Combine	2.0	0.5	2.7	Tons	Rod Weeder	0.3389	Other	37.0	10.1	73.8		0	0							Peas
Washington	Winter Wheat	04/16	11/13	320	104	451	Combine	55.5	9.8	130.0	Bu	Rod Weeder	0.2890	Other	71.7	10.0	700.4		0	0							Peas
Wisconsin	Alfalfa	03/31	05/17	474	38	1195	Hay	3.2	3.1	3.2	Tons	Cultipacker	0.4500								Dairy (lagoon)-Liquid effluent			0	0		Annual Rye
Wisconsin	Corn	04/07	06/22	137	75	193	Combine	199.7	159.0	239.0	Bu	Chisel Plow	0.3141	Other	133.7	119.0	192.0		0	0	Dairy (lagoon)-Liquid effluent			0	0		Annual Rye
Wisconsin	Sorghum	05/15	05/15	113	113	113	Cut Silage	219.0	219.0	219.0	Bu	Chisel Plow	0.3000														Annual Rye
Wyoming	Corn	05/05	07/15	135	109	184	Combine	65.6	50.0	80.0	Bu	Field Cultivator	0.5817	Other	88.3	36.0	131.0		0	0	Beef (dirt lot)-Solid manure			0	0		
Wyoming	Millet	06/01	07/15	101	87	122	Combine	0.9	0.8	1.0	Tons	Field Cultivator	0.3688	Other	40.0	40.0	40.0		0	0	Beef (dirt lot)-Solid manure			0	0		
Wyoming	Sunflower	07/01	07/23	88	77	121	Combine	700.0	700.0	700.0	Lbs	Strip-Till	0.2400	Other	70.0	50.0	90.0		0	0							
Wyoming	Winter Wheat	09/15	11/14	298	243	412	Combine	55.0	30.0	80.0	Bu	Strip-Till	0.5035	Urea	67.9	40.0	83.0				Beef (dirt lot)-Solid manure			0	0		

APPENDIX 3: UNCERTAINTY

Calculation for Uncertainty Deductions and Carbon Credits

This document elaborates on the calculation of uncertainty and what sources of uncertainty are included. Uncertainty deductions are estimated separately for each GHG source within a project. Deductions are based on an estimate of the **total error** of the project's calculated GHG emission reductions or removals for that source **over a given verification (monitoring) period**.

In a particular monitoring/reporting period, the target CO_2 emission reductions and removals across the entire project is denoted as τ, in tonnes of CO2 equivalent (t CO2e). We estimate each source of emissions separately, so our estimator of the total emissions reduction in a monitoring period is the sum of four estimators:

$$\hat{\tau} = \hat{\tau}_{SOC} + \hat{\tau}_{N2O} + \hat{\tau}_{CH4} + \hat{\tau}_{CO2} \tag{1}$$

We quantify nitrous oxide, methane, and carbon dioxide from fossil fuels using default equations. Due to precedents in previous carbon offset methodologies, no uncertainty is assumed for default equations.

Therefore, this section only details sources of error and methods to estimate $\hat{\tau}_{SOC}$ in an uncertainty assessment and calculation of the required uncertainty deduction for CO_2 removals from SOC change while using Quantification Approach 1 as described in VM0042 (version 2.0).

Soil Sampling Design and Modeling

At Agoro Carbon Alliance, all fields are sampled fields. And we conduct modeling at the field-stratum level for all growers instead of selected fields (Fig. 1). Stratified random sampling is our designed sampling strategy. The average measured initial SOC stocks from soil samples within each stratum is used (or back-modeled) as model input at t0 - the beginning of practices implementation year. This reduces sampling bias by ensuring that all variations within a landscape are represented. By using the average SOC stocks from each stratum, it helps in managing the variability in larger areas and simplifies the modeling process. This method is especially beneficial in heterogeneous landscapes where SOC distribution is expected to vary significantly due to differing land uses or soil types. This ensures that all parts of the project area are adequately represented in the sampling and modeling. Therefore, the DayCent model is run in a manner to represent a modeling unit/point (Fig. 1) in space at which initial soil data and management data have been collected, and uncertainty is calculated by combining estimates of sampling, modeling and measurement error based on the design.

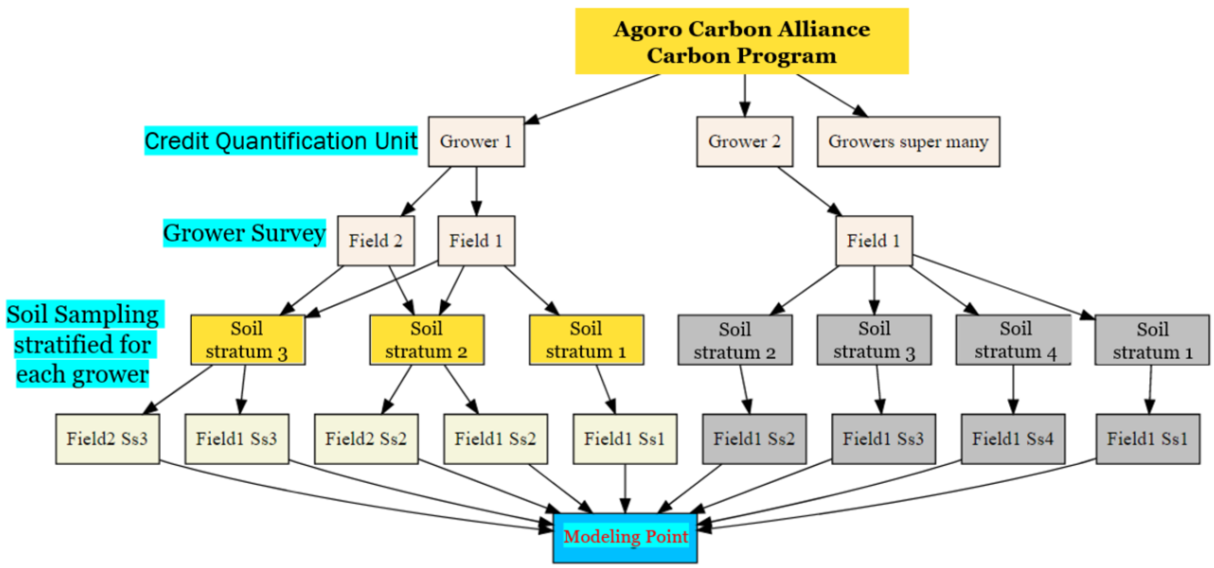


Figure 1. Modeling units configured by soil stratum and land management field.

Key sources of error accounted

Quantification Approach 1 is a measure and model approach in which a biogeochemical model is used to simulate changes in SOC stocks over a given time (monitoring) period in both the project and baseline scenarios. Initial measures of SOC are taken at the project start for use within the model. SOC is periodically remeasured throughout the project period to true-up modeled estimates of SOC stock changes. Key sources of error accounted for under Quantification Approach 1 include:

- Model prediction error resulting from uncertainty in model parameters and model structural errors (i.e., inaccurate representation of actual biogeochemical processes). Agoro Carbon accounts for model prediction error by calibrating models to include parameter uncertainty (a Bayesian implementation of the model) and using the Monte Carlo (MC) error propagation.
- Uncertainty of SOC stock from sampling and lab measurement.
- Measurement error of model inputs, including initial SOC content, bulk density, soil texture, and management data, where applicable. The impact of these measurement errors on the error of estimated reductions and removals is assumed to be captured in model prediction error and/or sampling error.

Monte Carlo simulation for uncertainty estimation

For emissions from changes in SOC, we run DayCent with the Monte Carlo method (with L=240 simulations) for each modeling unit for all fields, and our estimator for τ_{SOC}, denoted by $\hat{\tau}_{SOC}$, is obtained by averaging across those model simulations. We quantify uncertainty using the MC methods presented in the VM0042 Section 8.6.1.2 (version 2.0). It can be understood as a type of *design-based* inference (where randomness arises from the choice of where to collect soil samples to represent the stratum) but where the "measurements" have significant error because a process model is used to predict emissions removal at each modeling unit.

To generate an estimate ($\hat{\tau}_{SOC}$) of τ_{SOC}, the SOC dynamics are simulated under the baseline and project scenarios multiple times at each modeling unit, indexed by l = 1, ..., L. The CO2 removals at each modeling unit are then calculated as the difference between baseline and project scenarios. These estimates are used to produce an estimate of removals ($\tilde{y}$) at each modeling unit, indexed by l following the equation below:

$$\tilde{y}_{g,f,im,l,t} = \tilde{z}_{wp,g,f,im,l,t} - \tilde{z}_{bsl,g,f,im,l,t} \qquad (2)$$

Where:

$\tilde{y}_{g,f,im,l,t}$ = Predicted removals from SOC change for the monitoring period *t* on an area basis for the *l*th MC simulation at modeling unit *im* in field *f* for grower *g* (t CO2e/ha)

$\tilde{z}_{wp,g,f,im,l,t}$ = Predicted removals from SOC change for the monitoring period *t* in the project scenario on an area basis for the *l*th MC simulation at modeling unit *im* in field *f* for grower *g* (t CO2e/ha)

$\tilde{z}_{bsl,g,f,im,l,t}$ = Predicted removals from SOC change for the monitoring period *t* in the baseline scenario on an area basis for the *l*th MC simulation at modeling unit *im* in field *f* for grower *g* (t CO2e/ha)

l = 1, ..., L MC simulations (with $L = 240$ MC draws)

The total set of L estimates of $\tilde{y}$ are then used to produce $\hat{\tau}_{SOC}$:

$$\hat{\tau}_{SOC} = \sum_{g=1}^{G} \hat{\tau}_{SOC,g}$$

$$\hat{\tau}_{SOC,g} = \sum_{im=1}^{M_{g,f}} \left(\frac{A_{g,f,im}}{L} \sum_{l=1}^{L} \tilde{y}_{g,f,im,l,t} \right) \quad (3)$$

Where:

$\hat{\tau}_{SOC}$ = MC mean of total CO_2 removals from SOC change across the whole project area (t CO2e) during the monitoring period *t*

$\hat{\tau}_{SOC,g}$ = MC mean of CO_2 removals from SOC change for grower *g* (t CO2e) for the monitoring period *t*

The total uncertainty is then decomposed into two components, sampling and modeling uncertainty. Using standard variance decomposition (i.e., the law of total variance) following Del Grosso et al. (2010) as:

$$Var(\hat{\tau}_{SOC}) = Var(E[(\hat{\tau}_{SOC}|s)]) + E(Var[(\hat{\tau}_{SOC}|s)]) \quad (4)$$

Where:

$Var(E[(\hat{\tau}_{SOC}|s)])$ = Estimate of uncertainty due to sampling design which leads to different modeling units within a field (variance of the conditional expectation) (t CO2e)^2

$E(Var[(\hat{\tau}_{SOC}|s)])$ = Estimate of model uncertainty (expectation of the conditional variance given the sample design) (t CO2e)^2

S = The realized sample, selected using the sample design

The variance components are estimated according to the following system of equations.

$$\widehat{Var}(\hat{\tau}_{SOC}) = S^2_{sampling} + S^2_{model} = \left\{\sum_{g=1}^{G} S^2_{sampling,g}\right\} + S^2_{model} \quad (5)$$

Where:

$$S^2_{sampling,g} = \sum_{f=1}^{F} \quad S^2_{sampling,f} = \sum_{f=1}^{F} \quad \frac{{A_f}^2}{n_{im}(n_{im}-1)} \sum_{im=1}^{n} \quad \left(\hat{y}_{f,im} - \hat{\mu}_{SOC,f}\right)^2$$

$$\hat{\mu}_{SOC,f} = \frac{\hat{\tau}_{SOC,f}}{A_f}$$

$$S^2_{model} = \frac{1}{L-1} \sum_{l=1}^{L} \quad \left(\tilde{\tau}_{SOC,l} - \hat{\tau}_{SOC}\right)^2 \tag{6}$$

$\hat{y}_{f,im} = \left(\frac{1}{L}\right) \sum_{l=1}^{L} \quad \tilde{y}_{g,f,im,l,t}$ = The posterior predictive mean SOC emissions reduction at modeling unit *im* (t CO2e/ha)

$\hat{\mu}_{SOC,f}$ = The estimated areal-mean SOC emissions reduction in field *f*

$\tilde{\tau}_{SOC,l} = \sum_{g=1}^{G} \quad \hat{\tau}_{SOC,g,l}$ = The lth draw from the posterior preditive distribution for the total CO_2 removals from SOC change for grower g.

Calculation of uncertainty deduction

The uncertainty deduction is estimated for CO_2 removal from SOC changes within the project boundary. This deduction is estimated using a probability of exceedance methods (see the *VCS Methodology Requirements* Section 2.4), in which credits are issued at the 33.3rd percentile, so that there is a 66.6% chance that the true emission reduction exceeds the credited amount. To do so, a normal distribution is assumed for the distribution of MC estimates of the total emissions removal during the reporting period of interest ($\hat{\tau}_{SOC}$). That distribution reflects sampling variance and the range of values consistent with the plausible errors of the biogeochemical model (model variance), among other sources of uncertainty. Since the variance is calculated in the unit of $(tCO2e)^2$, the uncertainty deduction is expressed in terms of $\hat{\tau}_{SOC}$ of the total CO_2 removal from SOC changes:

$$UD = \frac{\sqrt{\hat{Var}(\hat{\tau})} \times t_{\alpha=0.666}}{\hat{\tau}_{SOC}} \times 100 \tag{7}$$

where t_{α}=0.666 is the critical value of a one-sided student's t-distribution at significance level α= 0.666 (66.6%), equal to approximately 0.4307 (dimensionless).