ACTIVITY MODULE METHODOLOGY

SOIL ORGANIC CARBON ACTIVITY MODULE FOR ENHANCING CARBON STOCKS IN MANAGED PASTURE

SDG 13

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RELATED DOCUMENTS:

Soil Organic Carbon Framework Methodology, Version 1.0

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1| Summary

The Special Report on Climate Change and Land, published by the Intergovernmental Panel on Climate Change (IPCC) in 2019, highlighted the contribution of land use change and food production systems to global greenhouse gas (GHG) emissions, which are approximately 23% of all emissions. If global emission targets are to be met, emissions from food production must be significantly reduced and carbon sequestration opportunities on farmland must be realised whenever reasonably possible.

Planted and managed pasture is a key source of nutrition for livestock, particularly in dairy production. The improved management of pastures may sequestrate additional carbon, thereby increasing soil organic carbon (SOC) stocks over time. However, it’s important to report both the changes in SOC as well as the net change in GHG emissions due to the project once potential changes in fossil fuel, fertiliser, and manure use are considered.

This module focuses on defining, monitoring, and reporting the improved management of pasture. Although the module was developed for managed pastures in dairy production in Finland, it is applicable regionally in the EU.

1.1 | Initial Project Context and Activities

In a baseline scenario, pastures in the project area might or might not be tilled and sown at a certain regular interval (e.g., once every four years).

Eligible project scenario activities include the following:

- Mowing/cutting and harvesting grass at **a longer length** in comparison with a baseline scenario.
- Sowing and cultivating a **more diverse set of pasture species** in comparison with a baseline scenario.
- Sowing and cultivating pasture species **with deeper root systems** in comparison with a baseline scenario.
- Improved grazing management that leads to an increase in SOC.
- **Tillage practices that may remain unchanged from a baseline scenario or may change to reduced or zero tillage from a baseline to a project scenario.**
- Fields that might be irrigated or rain-fed; if irrigated, projects shall account for GHG emissions from energy required for irrigation.

1.2 | Key Considerations

The envisaged pasture management system includes a broad range of GHG emissions sources, each of which shall be carefully considered to understand the net GHG emission impact of the project as well as potential leakage. These include emissions from:

- diesel usage, particular for traction, and

- the application of nitrogen-based fertilisers, and
- the application of manure, and
- ploughing, turnover of soil, release of SOC.

A monitoring framework is required to adequately measure and report the net change in fossil fuels, fertiliser, and manure usage due to the project. This includes any significant increases in carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) emissions from the project. A baseline period of five years is proposed (prior to the start of the project), with an annual baseline activity rate for each of these sources to be established.

Soils shall be sampled for SOC:

- at the start of the project, and
- in the same cropping season, and
- at the same time of year in terms of annual practices, for example, to collect soil samples before the start of the first management activity (input or tillage event) in each year.

To allow for combination of eligible practices and to account for potential release of carbon into the atmosphere following tillage or other soil disturbances, Approach 1 (direct measurement) is the only quantification approach allowed under this SOC Activity Module for both baseline and project scenarios. If measurement is regularly taken following a standardised protocol shortly after tillage, it would allow the impact of the project on SOC to be measured and reported in a robust manner. A modelling method (Approach 2) could be included in a future iteration of this SOC Activity Module.

2| Definitions and References

2.1 | Definitions

2.1.1 | Terms and definitions are listed in the SOC Framework Methodology (Section 2.1), and the following module-specific definitions also apply:

Term	Definition
Conventional tillage	Seedbed preparation using cultivation instruments such as harrows, mouldboard ploughs, offset harrows, subsoilers, and rippers. Conventional tillage methods involving extensive seedbed preparation cause the greatest soil disturbance and leave little plant residues on the surface.
Pasture	Area covered with grass or other plants that are suitable for grazing of livestock; grassland (IPCC, 2019).

Term	Definition
Managed pasture	Land that is actively managed through additional measures such as tillage, sowing of seed, mowing, harvesting, and grazing by livestock.

Reference: IPCC (2019). Annex I: Glossary. Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and GHG fluxes in terrestrial ecosystems. Retrieved from https://www.ipcc.ch/srccl/chapter/glossary/.

3| Applicability

3.1.1 | A project applying this SOC Activity Module shall comply with the applicability conditions specified below and those in the SOC Framework Methodology. In addition, the project shall comply with applicable Land Use & Forests Activity Requirements (hereafter LUF Activity Requirements) and the Gold Standard for the Global Goals Principles & Requirements (hereafter Principles & Requirements).

3.1.2 | Applicability Conditions

- Projects are eligible in all countries in the EU.
- Entire farms or selected fields or areas of farms are eligible (see Section 5.1, Project Boundary).
- The eligible project area shall have been cultivated cropland or pasture for at least 10 years before the project start date. The implementation of the project cannot lead to deforestation or the ploughing and cultivation of native land (e.g., indigenous native grassland). A quantitative remote sensing assessment is required to demonstrate compliance with this requirement. If the implementation of the project does lead to a decrease in woody carbon stocks (e.g., through clearing trees and bushes in non-forest land), the change in woody carbon stocks needs to be accounted for and estimated using a recognised methodology (e.g., Clean Development Mechanism tool: *Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/RCDM project activities*). Follow the guidance of Annex C of the LUF Activity Requirements for conducting quantitative spatial assessments.
- Eligible project scenario activities are as follows:
  - Mowing/cutting and harvesting grass at **a longer length** in comparison with a baseline scenario.
  - Sowing and cultivating a **more diverse set of pasture species** in comparison with a baseline scenario.
  - Sowing and cultivating pasture species **with deeper root systems** in comparison with a baseline scenario.

  - **Tillage practices that may remain unchanged from a baseline scenario or that may change to reduced or zero tillage from a baseline to a project scenario.**
  - Fields that might be irrigated or rain-fed; if irrigated, projects shall account for GHG emissions from energy required for irrigation.

- The increase in GHG emissions from the combustion of fossil fuels and the application of fertiliser and manure due to the project, including changes in CO_2, N_2O, and CH_4 emissions, shall be reported and accounted for. Fertiliser use per hectare shall follow national regulations.

- In line with the SOC Framework Methodology, this module accounts only for benefits in the SOC pool. No other pools or emission reductions (e.g., reductions in N_2O due to reduced fertiliser need) shall be accounted for as benefits.

- Organic matter inputs to project lands are permitted as long as they do not lead to leakage (i.e., a reduction in carbon stocks or additional emissions elsewhere) and all related emissions (including production and transport emissions) are accounted for. If off-field emissions are not calculated for organic inputs, change in organic input quantities shall be limited to below significance levels (i.e., less than 5% in terms of GHG emissions).

- The tillage regime practiced in the baseline scenario can be maintained in a project scenario. However, an increase in tillage activity and/or depth in a project scenario is not permitted (i.e., an area under reduced or no tillage in a baseline scenario cannot be changed to full tillage in the project scenario).

- Although irrigation is permitted, responsible water management and water conservation shall be illustrated, especially in regions with limited water supply and catchment water supply constraints. If present in the catchment, adherence to established water and irrigation regulation and management systems shall be proven.

- Evidence shall be provided that locally appropriate sustainable pasture management guidance is followed. Such guidance could be provided by national agricultural agencies, agricultural institutes, or commercial providers.

4| Additionality

4.1.1 | All Gold Standard projects shall demonstrate that they would not have been implemented without the benefits of carbon revenue. Specific rules and guidelines on how to assess additionality can be found in the Additionality section of the LUF Activity Requirements and the Additionality Requirements for Agriculture Projects Template.

5| Project Boundaries

5.1 | Spatial Boundary

5.1.1 | For spatial boundaries, rules and requirements defined in the SOC Framework Methodology apply.

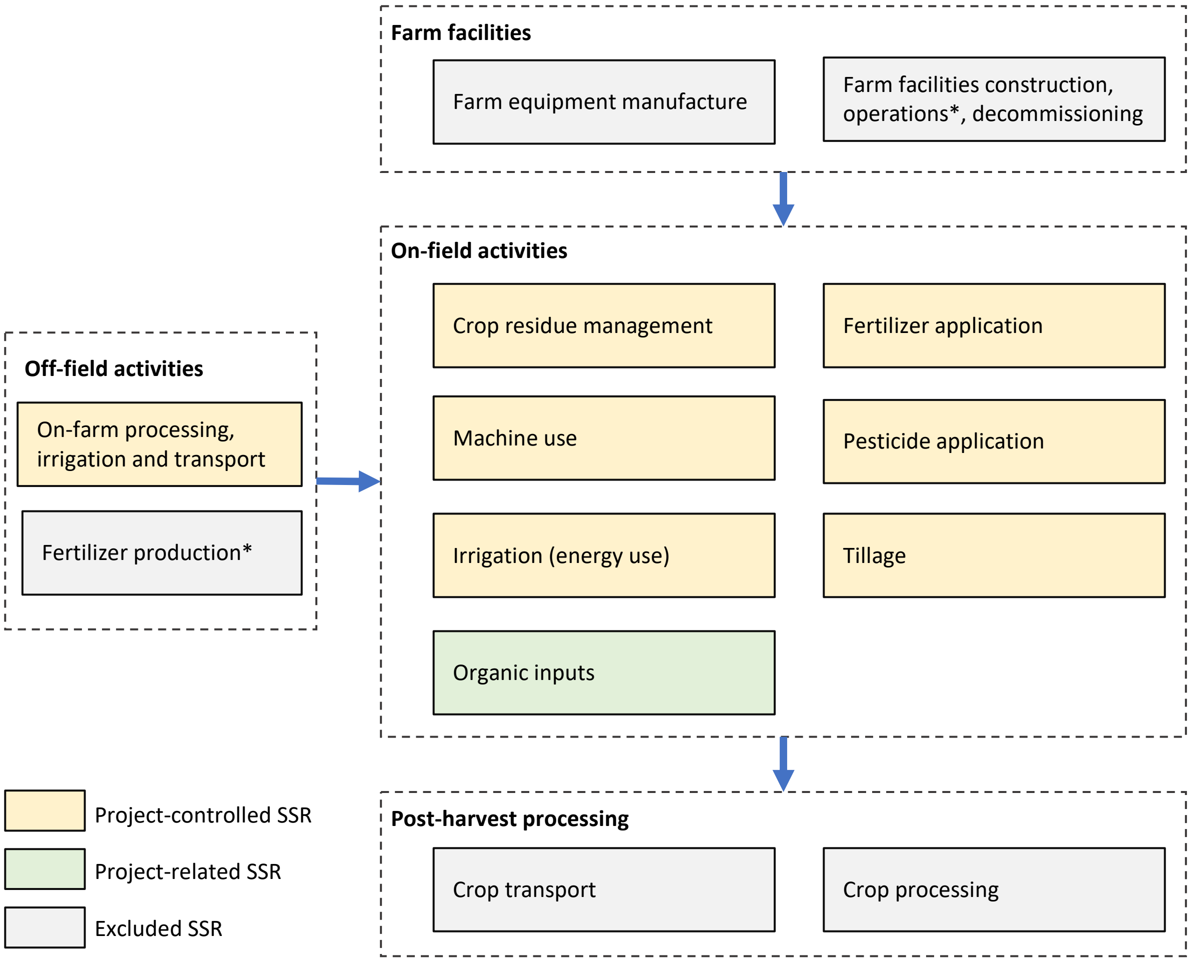
5.1.2 | Spatial boundary descriptions specific to this SOC Activity Module are as follows:

- Entire farms or selected fields or areas of farms are generally eligible. If the project is implemented only in selected fields, all applicability conditions and requirements from the SOC Framework Methodology and this SOC Activity Module shall be applied to these fields. The fields shall remain in the project during the entire crediting period (i.e., no change of participating fields on a farm during the crediting period is allowed).

- This SOC Activity Module requires GHG sources, sinks, and reservoirs as identified in Figure 5-01 to be considered, with a focus on their impact on SOC and increase of emissions from the project. The boundary thus includes all impacted field activities (machine use, tillage, and application of fertiliser and pesticides). GHG emissions generated through irrigation (to power pumps) shall be included. As SOC increase is driven also through inputs of biomass (root and residue), residue management is essential to assess SOC impact. For the same reason, other organic inputs (e.g., manure, compost) shall be monitored.

- Changes in GHG emissions from on-farm processing of produce associated with the project, irrigation, and transport shall be reported. GHG emissions from transport after leaving the boundary of the farm do not need to be reported.

Figure 5-01: Spatial Project Boundary



** Fertilizer production, farm equipment and facilities operations are excluded under the assumption that no significant changes to these sources of emissions occur due to the project activity.*

5.2 | Temporal Boundary

5.2.1 | This SOC Activity Module requires a crediting period of 10 years to account for the slow SOC buildup and to ensure long-term SOC impacts. The crediting period can be renewed once. A total potential project period of 20 years is allowed.

5.3 | Carbon Pools

5.3.1 | Carbon Pool Description

- In line with the SOC Framework Methodology, this SOC Activity Module accounts for only those benefits in the SOC pool. Additional pools (e.g., biomass and litter) may be used for calculation of SOC change, but no GHG sequestration in pools other than soil carbon shall be accounted for as benefits.

- No emission reduction from other GHG sources (e.g., fossil fuel use or fertiliser application) shall be reported for benefits under this methodology. To account for emission reductions from reduced fuel use or fertiliser application, a separate Gold Standard methodology shall be applied.

5.4 | Greenhouse Gases

5.4.1 | Following the SOC Framework Methodology, all GHG sinks and sources affected by its activities shall be monitored.

5.4.2 | This SOC Activity Module specifically includes any significant increases in CO_2, CH_4, and N_2O emissions from the project.

5.4.3 | In this context, the amounts and types of fertiliser and manure applied in a baseline and project scenario shall be reported together with the potential CO_2, CH_4, and N_2O emissions that may be generated through their application.

6| Emission Reduction Quantification Approach

Calculations for overall benefits follow the equations set out in the SOC Framework Methodology section titled Emissions Reduction Quantification Approaches. The following sections are approaches and calculations that are specific to this SOC Activity Module.

6.1 | Approaches for Baseline and Project Scenario Quantification

6.1.1 | This SOC Activity Module allows application of quantification Approach 1 as described in the SOC Framework Methodology.

6.1.2 | Application of Approaches 2 (models based on peer-reviewed publications) and 3 (default equations and parameters) are not allowed, due to a lack of supporting research and concern about the impact of tillage and changes in grass harvesting height on the enhancement of SOC stocks in managed pasture over time.

6.2 | Approach 1 (On-Site Measurements of SOC)

6.2.1 | Additional requirements are listed below.

- Soils shall be sampled for SOC:
  - at the start of the project, and
  - before performance certification in the same cropping season, and
  - at the same time of year in terms of annual practices, for example, to collect soil samples before the start of the first management activity (input or tillage event) in each year.
- In line with the SOC Framework Methodology, soil samples shall be collected to a depth of 50 centimetres.

- Bulk density shall be considered in all quantification approaches. Quantification shall be done on an "equivalent mass basis" to properly quantify carbon impacts.

- Special care shall be taken to ensure that superficial litter (crop residue) is not included in the SOC quantification.

6.2.2 | Uncertainty of the SOC quantification under project conditions shall be considered according to Gold Standard uncertainty requirements and following uncertainty assessment as outlined in the SOC Framework Methodology.

7| Baseline Scenario

7.1 | Baseline Calculations

7.1.1 | Quantification for SOC in the baseline (SOCBL,y) shall follow the rules, approaches, calculations, and parameters set out in the SOC Framework Methodology section titled Baseline Scenario.

7.1.2 | Baseline data is required for five years as required by the SOC Framework Methodology. If five-year baseline data is not fully available for a field within a stratum (e.g., it was leased less than five years prior to project start), evidence shall be provided that average baseline conditions for the stratum apply to the field lacking data.

7.1.3 | To determine the baseline of the eligible project area, the land shall be stratified into modelling units (MUs) according to criteria set out in Section 6 of the SOC Framework Methodology.

The following criteria also shall be considered in stratification:

- Mineral soil type.
- Tillage practices (e.g., tillage depth, frequency, tillage equipment).
- Specific grass species planted.
- Specific crops (or crop rotations) and production periods
- Irrigation—presence and type.

For each stratum (MU), SOC measurements shall be performed (Approach 1).

8| Project Scenario

8.1 | Project Calculations

8.1.1 | Quantification for SOC in the project scenario (SOCt,y) shall follow the rules, approaches, calculations, and parameters set out in the SOC Framework Methodology section titled Project Scenario.

8.1.2 | This SOC Activity Module addresses the change in SOC due to changes in management practices. Quantifications shall consider changes in all practices, including crop management, fertilisation, and application of other agrochemicals and manure.

8.1.3 | If other agricultural activities are introduced in a project, interactions shall be considered by applying the same SOC quantification approach (Approach 1).

8.1.4 | For the project scenario, the eligible project area shall be stratified into MUs according to criteria set out in Section 7 of the SOC Framework Methodology.

The following criteria also shall be considered in stratification:

- Mineral soil type.
- Tillage practices (e.g., tillage depth, frequency, tillage equipment).
- Specific grass species planted.
- Specific crops (or crop rotations) and production periods.
- Irrigation—presence and type.

For each stratum (MU), SOC measurements shall be performed (Approach 1).

9| Uncertainty

9.1.1 | Calculation of uncertainty shall follow the rules and equations set out in the SOC Framework Methodology.

10| Other Emissions

10.1.1 | Significant additional GHG emissions (>5% total) due to the project shall be accounted for. For this SOC Activity Module, this explicitly includes emissions from increased fertiliser input, fossil fuel combustion, and other agrochemical emissions. Calculation thereof shall follow the rules and equations set out in the SOC Framework Methodology.

10.1.2 | As emissions may differ between strata, calculation for this SOC Activity Module shall follow the rules and equations 1-7 described below, which replace the area-wide calculation set out in equations 12-18 of the SOC Framework Methodology. They follow the same approach but allow application of different emission factors and quantities for different strata.

$$PE_{t-0} = \Delta FE_{t-0} + \Delta FU_{t-0} + \Delta AE_{t-0} \quad (1)$$

Where:

PE_{t-0} = *emissions from project in the calculation period [tCO_2e]*
ΔFE_{t-0} = *emissions from increased fertiliser use in the calculation period [tCO_2e]*
ΔFU_{t-0} = *emissions from increased fuel and electricity use in the calculation period [tCO_2e]*
ΔAE_{t-0} = *other agrochemical emissions in the calculation period [tCO_2e]*

10.2 | Increased Nitrogen Fertiliser Input

10.2.1 | Per the Gold Standard Safeguarding Principles and Requirements (version 1.2, October 2019), the use of fertilisers shall be avoided or their use shall be minimised and justified. If the aerial application of fertiliser is used, measures shall be put in place to prevent drift.

10.2.2 | Emissions from increased nitrogen (N) fertiliser input in project scenario as compared with the baseline scenario are calculated as follows. No differentiation is made between synthetic and organic N fertiliser. This equation shall not be applied for reductions in N fertiliser input, in which case ΔFE_{t-0} is considered 0. To account for reductions in fertiliser input and the respective GHG emissions reductions, a separate Gold Standard methodology shall be applied.

$$\Delta FE_{t-0} = \sum_{y}\left[EF_{FE,y} \times \sum_{a=1}^{T}\left(FE_{PR,y,a} - FE_{BL,y}\right)\right] \quad (2)$$

Where:

ΔFE_{t-0}	*= emissions from increased fertiliser use in the calculation period [tCO_2e]. Must be ≥ 0 in this methodology (i.e., no accounting of reductions).*
$FE_{PR,y,a}$	*= N fertiliser input in stratum y under the project scenario in year a of the calculation period [kgN/yr]*
$FE_{BL,y}$	*= mean annual N fertiliser input in stratum y under the baseline scenario [kgN/yr]*
T	*= number of years in the calculation period [yr]*
$EF_{FE,y}$	*= Conversion factor for emissions from N fertiliser in stratum y [$tCO_2e\ kgN^{-1}$]. IPCC 2019 aggregated default value[1] for EF_{FE} is 0.01. Disaggregated default values in IPCC 2019 Table 11.1 may be used if fertiliser inputs are known per fertiliser type.*

FE_{PR} and FE_{BL} shall be documented by the project developer. For FE_{BL}, mean annual input is calculated based on respective management records for five years prior to project start. If no adequate documentation can be provided, FE_{BL} shall be no more than 50% of FE_{PR}. In addition, further FE_{PR} and FE_{BL} requirements defined in the SOC Framework Methodology shall be reviewed and adhered to.

10.3 | Increased Combustion of Fossil Fuels and Electricity Use

10.3.1 | Additional CO_2 emissions from use of fossil fuel and electricity in the project (e.g., fuel used by farm machines or fuel/electricity for irrigation pumps) shall

[1] IPCC 2019, Vol 4 AFOLU, Table 11.1 (Aggregated default value)

be accounted for, unless project developer can demonstrate that fossil fuel/electricity used in the project scenario is less than or does not differ significantly from fossil fuel/electricity used in the baseline, in which case ΔFU_{t-0} is considered 0.

$$\Delta FU_{t-0} = \sum_y \left[\sum_{a=1}^{T} \left(FU_{PR,y,a} - FU_{BL,y}\right) + \left(EU_{PR,y,a} - EU_{BL,y}\right)\right] \quad (3)$$

Where:

ΔFU_{t-0} = *emissions from increased fossil fuel and electricity use in the calculation period [tCO_2e]*
$FU_{PR,y,a}$ = *emissions from use of fossil fuels in stratum y under the project scenario in year a of the calculation period [tCO_2e]*
$FU_{BL,y}$ = *mean annual emissions from use of fossil fuels in stratum y under the baseline scenario [tCO_2e]*
$EU_{PR,y,a}$ = *emissions from use of electricity in stratum y under the project scenario in year a of the calculation period [tCO_2e]*
$EU_{BL,y}$ = *mean annual emissions from use of electricity in stratum y under the baseline scenario [tCO_2e]*
T = *number of years in the calculation period [yr]*

10.3.2 | FU_{PR} and FU_{BL} shall be documented by the project developer and calculated with the equation below, based on fuel consumption by machine type and fuel emission factor.

$$FU_{i,y,a} = \sum_{MT} FUL_{i,y,MT,a} \times FEF_{i,y,MT} \quad (4)$$

Where:

$FU_{i,y,a}$ = *emissions from use of fossil fuels in stratum y in year a [$tCO_2e\ ha^{-1}$]*
$FUL_{i,y,MT,a}$ = *fuel consumption in stratum y by the machinery type MT used in year a [litres/year]*
$FEF_{i,y,MT}$ = *emissions factor for the fuel used in stratum y in machinery MT [$tCO_2e\ litres^{-1}$]*
MT = *machinery type (gasoline two-stroke, gasoline four-stroke, diesel)*
i = *formula used for baseline (i=BL) as well as project scenario (i=PR)*

For FU_{BL}, mean annual emissions are calculated based on respective management records for five years prior to project start. If this is not available, the amount of fuel combusted can be estimated using fuel efficiency (for example l/100 km, l/tonne-km, l/hour) of the vehicle and the appropriate unit of use for the selected fuel efficiency (for example, kilometres [km] driven if efficiency is given in l/100 km). If no adequate documentation can be provided, FU_{BL} shall be no more than 50% of FU_{PR}.

Non-CO_2 GHG emissions caused by the use of fossil fuel from the project (management operations, machinery, etc.) are insignificant and thus may be neglected.

10.3.3 | EU_{PR} and EU_{BL} shall be documented by the project developer and calculated with the equation below, based on electricity consumption by appliance and respective emission factor. If electricity is generated on-site using fossil fuels (e.g., in diesel generators for irrigation pumps), emissions from fuel combustion shall be calculated instead, following the approach described above.

$$EU_{i,y,a} = \sum_{SE} EUW_{i,y,SE,a} \times EEF_{i,y,SE} \quad (5)$$

Where:

$EU_{i,y,a}$ = *emissions from electricity consumption in stratum y in year a [tCO_2e ha^{-1}]*
$EUW_{i,y,SE,a}$ = *electricity consumption in stratum y from source SE in year a [kWh/year]*
$EEF_{i,y,SE}$ = *emissions factor for the electricity used in stratum y in source SE [tCO_2e kWh^{-1}]*
SE = *electricity source type (grid, fossil fuel generator, etc)*
i = *formula used for baseline (i=BL) as well as project scenario (i=PR)*

For EU_{BL}, mean annual emissions are calculated based on respective management records for five years prior to project start. If no adequate documentation can be provided, EU_{BL} shall be no more than 50% of EU_{PR}.

10.4 | Other Agrochemical Emissions

10.4.1 | In line with Principle 9.6 of the Gold Standard Safeguarding Principles and Requirements, the project developer shall demonstrate that agrochemicals used in the project scenario are less than or do not differ significantly from agrochemicals used in the baseline, in which case ΔAE_{t-0} is considered 0.

$$\Delta AE_{t-0} = \sum_{y}\left[\sum_{a=1}^{T}\left(AE_{PR,y,a} - AE_{BL,y}\right)\right] \quad (6)$$

Where:

ΔAE_{t-0} = *additional emissions from project in the calculation period [tCO_2e]*
$AE_{PR,y,a}$ = *other emissions in stratum y under the project scenario in year a of the calculation period [tCO_2e]*
$AE_{BL,y}$ = *other emissions (annual mean) in stratum y under the baseline scenario [tCO_2e]*
T = *number of years in the calculation period [yr]*

10.4.2 | AE_{PR} and AE_{BL} shall be documented for each emitter type (agrochemical) by the project developer and calculated with the equation below, based on emission type, underlying quantity, and respective emission factor.

$$AE_{i,y,a} = \sum_{ET} AQ_{i,y,ET,a} \times AEF_{i,y,ET} \quad (7)$$

Where:

$AE_{i,y,a}$ = *emissions from use of other agrochemicals in stratum y in year a [tCO2e ha^{-1}]*
$AQ_{i,y,ET,a}$ = *quantity of agrochemicals in stratum y for emitter type ET applied in year a [kg]*
$AEF_{i,y,ET}$ = *emissions factor of the agrochemical used in stratum y (for emitter type ET) [tCO$_2$e kg^{-1}]*
ET = *emitter type (specific pesticide, fertiliser, or other agrochemical)*
i = *formula used for baseline (i=BL) as well as project scenario (i=PR)*

10.4.3 | For AE_{BL}, mean annual emissions are calculated based on respective management records for five years prior to project start. If no adequate documentation can be provided, FE_{BL} shall be no more than 50% of FE_{PR}. Further FE_{PR} and FE_{BL} requirements defined in the SOC Framework Methodology also shall be reviewed and adhered to.

10.5 | Consideration of GHG Emissions From Additional Livestock On-Site

A GHG emissions efficiency approach shall be taken when considering the GHG emissions emitted from additional livestock. The GHG emissions per unit output (e.g., milk) shall be equal to or less than that emitted in a baseline without-project scenario.

This approach recognises:

- the need to consume the additional primary production resulting from improved pasture and grassland management in an efficient manner (per unit produce), and
- the need to reduce the conversion of indigenous ecosystems to planted pastures and grasslands elsewhere to produce livestock (positive leakage), and
- the importance of livestock manure and urea in enhancing SOC and reducing the need for nitrogen fertiliser.

11| Leakage

11.1.1 | Calculation of leakage shall follow the rules and equations set out in the SOC Framework Methodology. If a reduction in yield is detected in a performance certification, it is assumed that the lost production capacity will be made up for on land outside the project area. Emissions caused by such a shift shall be accounted for as leakage according to the equation in the SOC Framework Methodology.

12| Monitoring

12.1.1 | Monitoring approach and parameters shall be followed as set out in the SOC Framework Methodology. The project developer also shall collect and document evidence that this SOC Activity Module's applicability conditions are met at all times.

12.1.2 | Additional requirements: The following parameters shall be monitored in this SOC Activity Module, depending on the quantification approach selected. Where these parameters overlap with the SOC Framework Methodology Monitoring section, these descriptions shall be applied under this SOC Activity Module to ensure stratum-level quantification and appropriate data sources.

12.2 | Data and Parameters Monitored

Summary List		
Data/Parameter:		Description
1.	$CY_{t,c,y}$	Average annual crop yield for crop type c per ha in stratum y in the project area (five-year average)
Equation 2: Changes in nitrogen fertiliser input		
2.	$EF_{FE,y}$	Conversion factor for emissions from N fertiliser in stratum y
3.	$FE_{BL,y}$	Mean annual N fertiliser input in stratum y under the baseline scenario
4.	$FE_{PR,y,a}$	N fertiliser input in stratum y under the project scenario in year a
Equations 3, 4, 5: Changes in the combustion of fossil fuels and electricity usage		
5.	$FEF_{i,y,MT}$	Emissions factor for the fuel used in stratum y in machinery MT
6.	$FUL_{i,y,MT,a}$	Fuel consumption in stratum y by the machinery type MT used in year a
7.	$EEF_{i,y,SE}$	Emissions factor for the electricity used in stratum y in source SE
8.	$EUW_{i,y,SE,a}$	Electricity consumption in stratum y from source SE in year a
Equations 6, 7: Other agrochemical emissions		
9.	$AQ_{i,y,ET,a}$	Quantity of agrochemicals in stratum y for emitter type ET applied in year a
10.	$AEF_{i,y,ET}$	Emissions factor of the agrochemical used in stratum y (for emitter type ET)

Data/Parameter 1:	$CY_{t,c,y}$
Unit	kg/ha
Description	Average annual crop yield for crop type c per ha in stratum y in the project area (five-year average)
Source of Data	Farm records, e.g., field records, sales receipts
Value(s) Applied	
Measurement Procedures	Yield is recorded for each crop season and cumulated annually (as sum of each crop type). Average annual yield is calculated for each stratum across the five-year reporting period.
Monitoring Frequency	Annually
QA/QC Procedures	
Additional Comments	This parameter replaces parameter CY_t in the SOC Framework Methodology (Equation 19). This value shall be reported as evidence that no yield reduction is taking place. The lowest annual yield is considered CY_{min} and serves as threshold to assess yield reduction.

Data/Parameter 2:	$EF_{FE,y}$
Unit	$tCO_2e\ kgN^{-1}$
Description	Conversion factor for emissions from N fertiliser in stratum y
Source of Data	IPCC 2019
Value(s) Applied	IPCC 2019 aggregated default value for EF_{FE} is 0.01. Disaggregated default values in IPCC 2019 Table 11.1 may be used if fertiliser inputs are known per fertiliser type.
Measurement Procedures	
Monitoring Frequency	Project start
QA/QC Procedures	
Additional Comments	Used in Equation 2

Data/Parameter 3:	$FE_{BL,y}$
Unit	kgN/year
Description	Mean annual N fertiliser input in stratum y under the baseline scenario
Source of Data	Farm records (field level)
Value(s) Applied	Average annual N input in stratum y, calculated across baseline period (five years)
Measurement Procedures	
Monitoring Frequency	Project start
QA/QC Procedures	

Data/Parameter 4:	$FE_{PR,y,a}$
Unit	kgN/year
Description	N fertiliser input in stratum y under the project scenario in year a
Source of Data	Farm records (field level)
Value(s) Applied	Sum of N inputs in stratum y in year a
Measurement Procedures	
Monitoring Frequency	Use-based, aggregated annually
QA/QC Procedures	
Additional Comments	Used in Equation 2

Data/Parameter 5:	$FEF_{i,y,MT}$
Unit	$tCO_2e\ litre^{-1}$
Description	Emissions factor for the fuel used in stratum y in machinery MT

Source of Data	a) National GHG inventory sources, such as: • EMEP/EEA air pollutant emission inventory guidebook 2019 — European Environment Agency (europa.eu) b) If no national data is available, default emission factors in IPCC 2006 Volume 2, Chapter 3, Table 3.3.1 may be applied (taking into account listed uncertainties).
Value(s) Applied	
Measurement Procedures	
Monitoring Frequency	Project start, annual review for national updates
QA/QC Procedures	
Additional Comments	Used in Equation 4

Data/Parameter 6:	$FUL_{i,y,MT,a}$
Unit	Litre/year
Description	Fuel consumption in stratum y by the machinery type MT used in year a
Source of Data	Farm records
Value(s) Applied	
Measurement Procedures	1) Document machines and fuel types for equipment used for zero tillage practices in each stratum. 2) Document amount of equipment use for zero tillage from: a. direct records (fuel use), or b. equipment usage (hours or distance) and fuel consumption (litres/hour or litres/km).
Monitoring Frequency	Baseline: Project start Project: Use-based documentation, aggregated (sum) per year
QA/QC Procedures	
Additional Comments	Used in Equation 4

Data/Parameter 7:	$EEF_{i,y,SE}$
Unit	$tCO_2e\ kWh^{-1}$
Description	Emissions factor for the electricity used in stratum y in source SE
Source of Data	a) National GHG inventory sources, such as: • EU: https://www.eea.europa.eu/publications/emep-eea-guidebook-2019 b) If no national data is available, default emission factors in IPCC 2006 Volume 2, Chapter 3, Table 3.3.1 may be applied (taking into account listed uncertainties).
Value(s) Applied	

Measurement Procedures	
Monitoring frequency	Project start, annual review for national updates
QA/QC procedures	
Additional comments	Used in Equation 5

Data/Parameter 8:	$EUW_{i,y,SE,a}$
Unit	kWh/year
Description	Electricity consumption in stratum y from source SE in year a
Source of Data	Farm records
Value(s) Applied	
Measurement Procedures	1) Document electric equipment and power source used for zero tillage practices in each stratum. 2) Quantify electricity used for zero tillage activity based on: a. direct records (electricity documentation), or b. duration of equipment use (hours) and power consumption per equipment type (kilowatt).
Monitoring Frequency	Annually: use-based documentation, aggregated (sum) per year
QA/QC Procedures	
Additional Comments	Used in Equation 5
Additional Comments	Used in Equation 2

Data/Parameter 9:	$AQ_{i,y,ET,a}$
Unit	kg
Description	Quantity of agrochemicals in stratum y for emitter type ET applied in year a
Source of Data	Farm records
Value(s) Applied	
Measurement Procedures	Documentation of quantity and type of non-N fertiliser agrochemicals used for cover crops (e.g., for termination)
Monitoring Frequency	Annually
QA/QC Procedures	
Additional Comments	Used in Equations 7 and 9

Data/Parameter 10:	$AEF_{i,y,ET}$
Unit	$tCO_2e\ kg^{-1}$
Description	Emissions factor of the agrochemical used in stratum y (for emitter type ET)
Source of Data	Supplier information
Value(s) Applied	
Measurement Procedures	Supplier Life Cycle Assessment information for production and transport. If no supplier information is available, national or international default values or third-party emission factors (e.g., from applicable studies on respective crop emissions) may be applied.
Monitoring Frequency	Annually
QA/QC Procedures	

Additional Comments	Used in Equation 9

Document History

Version	Date	Description
1.0	14/08/2024	First version