ACTIVITY MODULE METHODOLOGY

SOIL ORGANIC CARBON ACTIVITY MODULE - BIOSTIMULANTS FOR SOIL REVITALISATION

SDG 13

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SUMMARY

This Soil Organic Carbon (SOC) Activity Module prescribes requirements and guidance to quantify and monitor greenhouse gas (GHG) emissions and soil organic carbon (SOC) changes resulting from change in soil management practices within agricultural systems through application of biostimulants for soil revitalisation. The eligible activities are intended to achieve net carbon sequestration in the soil carbon pool. This activity module shall be applied in conjunction with the Soil Organic Carbon Framework Methodology.

This Activity Module is applicable for a wide area of technological levels, from low tech land use to industrialised land management, using eligible biostimulants for soil revitalisation. The mode of action of biostimulants for soil revitalisation is to act on microorganisms, for example to activate and stimulate the fungal flora. As microorganisms play a role in soil carbon sequestration, biostimulants for soil revitalisation can lead to soil carbon sequestration.

Under this SOC Activity Module, it is strongly recommended that biostimulants for soil revitalisation are introduced in project areas in conjunction with sustainable use and/or management of the soil, leading to an improvement in the soil characteristics

indicators throughout the lifetime of the project. These biostimulants shall be approved and/or registered by the competent authority and their efficacy shall be supported by peer-reviewed literature and/or published studies that are based on activity in the region or comparable region. The Activity Module does not restrict the use of other types of sustainable land management practices in the project areas.

This SOC Activity Module recommends using approach 1 to quantify SOC stocks for baseline and project scenario as described in the SOC Framework Methodology. Approach 1 involves on-site measurements to document pre-project and project SOC stocks. The project scenario shall include GHGs emissions from the production, transport and application of biostimulants. Approach 2 may also be applied following SOC Framework Methodology requirements.

A project applicant using this Activity Module may also identify, measure and quantify further beneficial ecosystem services towards other Sustainable Development Goals (SDGs), including but not limited to:
I. Zero hunger (food security/stabilisation of yield) (SDG 2),
II. Water supply and purification (SDG 6),
III. Responsible consumption and production (SDG 12),
IV. Life on Land (biodiversity) (SDG 15).

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1| DEFINITIONS

1.1.1 | In addition to terms and definition listed in the SOC Framework Methodology and GS4GG Glossary, the following definitions apply for the purposes of this activity module:

Term	Definition
Biostimulants	A biostimulant refers to a product (substances and/or microorganisms) independent of the product's nutrient content that used to stimulate natural processes and metabolism in soil to improve tolerance of abiotic stresses and optimise crop quality, facilitate the availability of nutrients, conditionate the rhizosphere and enhance soil microflora activity.
Life Cycle Assessment (LCA)	A life cycle assessment (LCA) is a method to evaluate the environmental impact of a product over its entire life cycle. It is a holistic approach that takes into account all the activities involved in the creation of a product, such as raw material extraction, manufacturing, transportation and distribution, use and disposal. For the purpose of this activity module, LCA is based only on greenhouse gases.

2| SCOPE, APPLICABILITY, AND ENTRY INTO FORCE

2.1 | Scope

2.1.1 | This activity module is applicable to project activities that use biostimulants for soil revitalisation.

2.2 | Applicability

2.2.1 | A project applying this Activity Module shall comply with the applicability conditions specified below and within the SOC Framework Methodology. In addition, the project shall comply with applicable Land Use & Forests Activity Requirements (hereafter LUF Activity Requirements) and the Principles & Requirements (hereafter Principles & Requirements).

2.2.2 | The Activity module is applicable under the following conditions:

a. Geographic location – The activity module is applicable globally.
b. Project area - The Project Area shall NOT include;
    i. riparian or other buffer zones located within such eligible areas, and excluding areas set aside for conservation in accordance with LUF Activity Requirements.
    ii. wetlands.
c. Soil type – the proposed activity involving sites with
    i. only mineral soil types are eligible.
    ii. organic soils (Histosols), as defined by the World Reference Base for Soil Resources (FAO 2015) are NOT eligible.
d. Land use – the proposed activity shall

i. have managed cropping systems (e.g. single crop or crop rotation) in practice for at least 5 years prior to project implementation.
ii. NOT lead to land use change E.g., conversion of existing natural grasslands to croplands

e. Soil management practices - Under this SOC Activity Module, biostimulants for soil revitalisation may be introduced in project areas in conjunction with sustainable use and/or management of the soil that leads to an improvement in the soil characteristics indicator(s) throughout the project, as demonstrated using Annex 1 of this activity module. If it is not possible, project developer shall explain in the PDD why improvement in soil characteristic indicators was not envisaged/ intended.

f. The biostimulants
i. shall have approval or be registered with the competent authority as a biostimulant or fertilising product with a biostimulant effect or soil improver function and not as a pesticide.
ii. shall have proven efficacy for soil revitalisation supported by peer-reviewed research literature[1] and/or published studies that are based on activity in the region or comparable region.
iii. shall NOT have an adverse effect on human, animal or plant health, on safety, or on the environment, under reasonably foreseeable conditions of storage or use. This maybe demonstrated via compliance to any regulations in the approval /registration process of the biostimulant or compliance to similar national/regional regulations. E.g., Regulation (EU) 2019/1009 of the European Parliament and of the Council of 5 June 2019[2].
iv. may include in its composition material from natural or mineral origin.
v. shall not include any Genetically Modified Organism (GMO) as a part of its composition.

[1] Peer-review publications in reputable journals that are indexed in the Web of Science: Science Citation Index (SCI; available at https://mjl.clarivate.com). Peer-review shall cite literature that is relevant to the climate zone.

[2] Regulation (EU) 2019/1009 of the European Parliament and of the Council of 5 June 2019 laying down rules on the making available on the market of EU fertilising products and amending Regulations (EC) No 1069/2009 and (EC) No 1107/2009 and repealing Regulation (EC) No 2003/2003. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32019R1009

3| ADDITIONALITY

3.1.1 | The regulatory surplus shall be demonstrated by all the projects, irrespective of scale. The project shall demonstrate that proposed activity is neither directly mandated by law nor otherwise triggered by legal requirements (e.g., legally binding agreements, covenants, consent decrees, or contracts (with government agencies or private parties). If such legal requirements are identified, then crediting for the activity shall only be allowed until the date the legal requirements take effect.

3.1.2 | All projects seeking Gold Standard certification 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 in the latest version of the Gold Standard SOC Framework Methodology.

4| PROJECT BOUNDARIES

4.1 | Spatial boundary:

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

4.2 | Temporal boundary:

4.2.1 | The maximum crediting period, depending on the efficacy of the biostimulant, shall be as follows:

a. 5 years – no renewal of crediting period is required, or
b. 10 years – crediting period renewal is required as per Principles and requirements.

4.2.2 | The crediting period starts either with the Project Start Date or three years prior to the date of Project Design Certification, whichever occurs later.

4.3 | Carbon Pools

4.3.1 | The project shall account for carbon pools for assessment in line with the SOC Framework Methodology. The soil organic carbon pool applicable to this module are as shown in Table 1

Table 1 – Emissions sources included in or excluded from the project boundary

Scenario	Carbon pools	CO_2	CH_4	N_2O
Baseline	SOC	Yes	No	No
Project	SOC	Yes	No	No
	Emissions from production and application of biostimulants	Yes	Yes	Yes
	Emissions from transportation of biostimulant from production facility to farm	Yes	Yes	Yes

4.4 | GHGs emissions

4.4.1 | The carbon pools other than SOC, applicable to the activity module are as follows:

a. Production and application of biostimulants
   i. GHGs emission from the production and application of biostimulants shall be included in the project scenario. The emissions during production and application of biostimulants are attributed to electricity and/or fossil fuel use.
   ii. GHGs emission from application of biostimulants can be neglected if the application of biostimulants is through one of the baseline practices and there is no additional use of energy (fossil fuel/electricity). E.g., Biostimulants are applied at the same time as seeding.

b. Transportation of biostimulants
   i. GHGs emission from transportation of biostimulants are considered insignificant (if less than 5% of the net emission reductions and sequestration) and may be omitted from monitoring.

5| EMISSION REDUCTION QUANTIFICATION APPROACH

Calculations for overall GHGs sequestration follow the equations set out in Section: Emissions Reduction Quantification Approaches of the SOC Framework Methodology. Sections below specify approaches and calculations specific to this SOC activity module.

5.1 | Approaches for baseline and project scenario quantification

5.1.1 | The baseline and project scenario SOC stocks measurements shall be done using either approach 1 or approach 2 as described in the SOC Framework Methodology.

5.1.2 | **Approach 1** - Requires on-site measurements to directly document pre-project and project SOC stocks.

5.1.3 | The projects using approach 1 shall demonstrate compliance to requirements established in SOC Framework Methodology for both baseline and project quantification. For baseline quantification, SOC stock measurements shall be done prior to application of biostimulants or any other practice being introduced in the project scenario alongside application of biostimulants.

5.1.4 | On-site SOC measurements will be carried out using:

a. an approved protocols for on-site measurements as listed in Annex 1 of SOC Framework Methodology, or

b. Annex 3 Soil sampling sub-protocol- GSOC-MRV Protocol[3] : It provides a standardised tool to support SDG 15.3.1., as well as any project related to SOC sequestration.

5.1.5 | For soil sampling the projects activity shall apply best practices, such as those described in Smith & al., 2020[4] or FAO, 2019[5]. The FAO protocol allows for stratified simple random sampling and directed stratified sampling designs. Composite samples are required. As a minimum, samples for SOC concentration determinations shall be obtained from 0-10 cm and 10-30 cm with the FAO protocol. However, samples from deeper layers up to 1 m can be collected. Sampling frequency must be as a minimum every 4 years and samples must be taken at the same time of year. For estimating bulk density, direct measurement methods shall be used, specifically the undisturbed (intact) core method and the excavation method.

5.1.6 | **Approach 2:** The projects using approach 2 shall demonstrate compliance to requirements established in SOC Framework Methodology for both baseline and project quantification.

5.1.7 | Appropriateness of models, datasets or calculation approaches and management practices changes proposed by project proponents to conservatively quantify both the baseline and project SOC stocks in the region(s) where the project is located shall be demonstrated through scientific peer reviewed publications.

5.1.8 | The selected models, datasets or calculation approaches shall be able to replicate project model simulations, maintain version control and fully report all parameter datasets. Where multiple parameters are utilised, selection and evidence for values shall be demonstrated via the use of peer reviewed literature. Also, appropriate description of statistical approaches used to set parameter values shall be provided. All models/calculation approaches must be validated against project data and the same parameters must be used in both the baseline and project scenario.

5.1.9 | Project developers shall prove that the research results are conservative and applicable to the project area and management practices using at least two peer reviewed papers from indexed journals.

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[3] FAO. 2020. A protocol for measurement, monitoring, reporting and verification of soil organic carbon in agricultural landscapes – GSOC-MRV Protocol. Rome. https://doi.org/10.4060/cb0509en

[4] How to measure, report and verify soil carbon change to realize the potential of soil carbon sequestration for atmospheric greenhouse gas removal. Smith, P. & al., 2020. Global Change Biology. Available at: https://onlinelibrary.wiley.com/doi/full/10.1111/gcb.14815

[5] Measuring and modelling soil carbon stocks and stock changes in livestock production systems: Guidelines for assessment (Version 1). FAO, 2019. Available at: https://www.fao.org/3/ca2934en/CA2934EN.pdf

6| BASELINE SCENARIO

6.1 | Baseline Calculations

6.1.1 | The soil organic carbon in the baseline ($SOC_{BL,y}$) shall be measured following the requirements described in Section:6 Baseline Scenario of the SOC Framework Methodology.

6.2 | Eligible baseline scenario calculation approach

6.2.1 | The applicable baseline scenario is the continuation of the historical land management practices that are being followed in last 5 years before the project start date. To determine the baseline of the eligible project area the land shall be stratified into modelling units (MU) according to:

a. Mineral soil type
b. Climate zone
c. Land management / cropping system
d. Input levels (e.g. fertilisation)
e. Tillage practices
f. Any other land management practices (e.g., irrigation)

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

7| PROJECT SCENARIO

7.1 | Project Calculations

7.1.1 | The soil organic carbon in the project scenario ($SOC_{t,y}$) shall be measured following the requirements described in Section 7: Project scenario of the SOC Framework Methodology.

7.2 | Eligible project scenario calculation approach

7.2.1 | Under the project scenario, as with the baseline, the eligible project area shall be stratified into modelling units (MU) according to:

a. Mineral soil type
b. Climate zone
c. Land management / cropping system
d. Input levels (e.g., fertilisation)
e. Tillage practices
f. Any other land management practices (e.g., irrigation)

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

7.3 | Other emissions

7.3.1 | Project activity emissions consist of GHGs emission from the production, transportation from the industrial facility to the farm, and application of the biostimulant. Significant greenhouse gas emissions (>5% of the total) due to the project activity need to be accounted for. GHG emissions considered insignificant (less than 5% of total emission reduction and sequestration) may be omitted from monitoring. Project owners shall calculate GHG emissions using the following approach:

a. Life Cycle Assessment

i. A life cycle assessment (LCA) shall be conducted

a. considering all the activities involved in the product life cycle, including at minimum production, transport, and application of biostimulants. AND

b. following the latest version of the recognised international standards, such as PAS 2050 issued by British Standards Institute (BSI)[6], GHG Protocol Product Life Cycle Standard[7], ISO standards (ISO 14040:2006)[8] and ISO 14044:2006[9],ISO 14067:2018[10].

ii. The project emissions are determined as follows:

$$PE_t = \Sigma^n (A_{(y)} \times Q_{PR,i,t,y} \times LCA_i) \quad \text{Eq (1)}$$

Where:

PE_t	=	total project emissions in the calculation period (tCO_2e)
$A_{(y)}$	=	Area of Stratum y (ha)
$Q_{PR,i,t,y}$	=	Quantity of biostimulant for soil revitalisation of type i used, before dilution, in each stratum y in the calculation period (t of biostimulant/ha)
LCA_i	=	Life Cycle Analysis emissions for the biostimulant for soil revitalisation of type i [tCO_2e/t of biostimulant]

[6] Specification for the assessment of the life cycle greenhouse gas emissions of goods and services - PAS 2050. British Standards Institute (BSI), 2011.

[7] Product Life Cycle Accounting and Reporting Standard. Greenhouse Gas Protocol, 2011. Available at: https://ghgprotocol.org/product-standard

[8] ISO 14040:2006 - Environmental management — Life cycle assessment — Principles and framework. ISO, 2016. Available at: https://www.iso.org/standard/37456.html

[9] ISO 14044:2006 - Environmental management — Life cycle assessment — Requirements and guidelines. ISO, 2016. Available at: https://www.iso.org/standard/38498.html

[10] ISO 14067:2018 - Greenhouse gases — Carbon footprint of products — Requirements and guidelines for quantification. Available at: https://www.iso.org/standard/71206.html

iii. The following requirements apply for conducting LCA:

a. LCA can be performed either by the producer of the product directly, project owner or a third party hired by the producer of the product. Where, the LCA is performed by the producer of the product or the project owner, the LCA shall be independently reviewed.

b. LCA used by the project owner shall not be more than one year old from the start date of the project.

c. LCA shall be repeated at least every 3 years or when there is a significant change (more than 5% of the original process) in the production, transportation, or application process of the biostimulant, whichever is earlier.

8| PROCEDURES FOR CALCULATION APPROACH CHANGE

8.1.1 | Any approach change between baseline and project scenario calculations shall be in compliance with requirements of section 8: Procedure for approach change of SOC Framework Methodology.

9| UNCERTAINTY

9.1.1 | The uncertainty estimation shall be conducted following requirements described in Section 9: Uncertainty of SOC Framework Methodology.

10| OTHER EMISSIONS

10.1.1 |Significant additional greenhouse gas emissions (>5% total) due to the project activity need to 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 requirement described in Section 10: Other emissions of the SOC Framework Methodology.

10.1.2 |LCA for biostimulants includes emissions from increased fertiliser input and other agrochemical emissions at the application stage. Emissions from increased fossil fuel combustion as compared to the baseline scenario are also included included in the Life Cycle Assessment.

11| LEAKAGE

11.1.1 | The leakage emission estimation shall be conducted following the requirements described in Section 11. Leakage of SOC Framework Methodology.

11.1.2 |The project site is being actively maintained for crop production during the project-crediting period, yield related leakage risks should be negligible, if any. Crop producers are commonly risk averse and are unlikely to

intentionally suffer reduced crop yields. Moreover, projects shall not lead to a decrease in agricultural productivity, thus all projects shall be set up to maintain or increase yield. Thus, for initial project calculations, LK_{t-0} is considered equal to 0.

11.1.3 |If a reduction in yield is detected in a performance certification, it is assumed that the lost production capacity will have to 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 listed in the SOC Framework Methodology.

12| MONITORING

12.1.1 |Monitoring parameters and approach shall identified and designed following the SOC Framework Methodology.

12.1.2 |In addition to the data and parameters listed in the SOC Framework Methodology, the following parameters shall be monitored and recorded. Data and Parameters collected for baseline calculation and when project areas (farms/land parcels) are being added and at renewable of crediting period if required.

a. Data and Parameters fixed:

Data/parameter:	Cropland Management Practices$_{BL,y}$
Unit	[dimensionless]
Description	Baseline management practices - Cropland management practices (such as tillage, manure inputs, cover crops) before project start in stratum y
Source of data	IPCC defaults or national / local studies / Farmer own records (preferred)
Value(s) applied	-
Measurement procedures	Farmer records. Where farmer records are not available, interviews can be conducted
Monitoring frequency	Project start
QA/QC procedures	-
Additional comments	-

b. Data and Parameters monitored:

Data/parameter:	LCAi
Unit	tCO2e/kg or tCO2e/L
Description	Life Cycle Analysis emissions for the biostimulant of type i
Source of data	Life Cycle Analysis performed by producer or product, project owner or third party

Value(s) applied	As per the conducted LCA
Measurement procedures	As per the latest version of the recognised international standards, such as PAS 2050 issued by British Standards Institute (BSI)[11], GHG Protocol Product Life Cycle Standard[12], ISO standards (ISO 14040[13], ISO 14044[14] and ISO 14067[15])
Monitoring frequency	Project start, repeated at least every 3 years or when there is material change in production, transportation or application procedure of the biostimulant.
QA/QC procedures	LCA shall not be more than 1 year old at the start of the project.
Additional comments	Project owner should provide the latest version of the LCA applicable at the time of start of project and any subsequent performance review and renewal of the crediting period.

Data/parameter:	$Q_{PR,i,t,y}$
Unit	t/ha
Description	Quantity of biostimulant for soil revitalisation of type i used, before dilution, in each stratum y in the calculation period
Source of data	Proof of product use (such as farm accounting, farmer records, product invoice or farmers' declarations)
Value(s) applied	As per source of data
Measurement procedures	-
Monitoring frequency	Annually

[11] Specification for the assessment of the life cycle greenhouse gas emissions of goods and services - PAS 2050. British Standards Institute (BSI), 2011.

[12] Product Life Cycle Accounting and Reporting Standard. GreenHouse Gas Protocol, 2011. Available at: https://ghgprotocol.org/product-standard

[13] ISO 14040:2006 - Environmental management — Life cycle assessment — Principles and framework. ISO, 2016. Available at: https://www.iso.org/standard/37456.html

[14] ISO 14044:2006 - Environmental management — Life cycle assessment — Requirements and guidelines. ISO, 2016. Available at: https://www.iso.org/standard/38498.html

[15] ISO 14067:2018 - Greenhouse gases — Carbon footprint of products — Requirements and guidelines for quantification. Available at: https://www.iso.org/standard/71206.html

QA/QC procedures	Cross check that biostimulant use is not more than the prescribed limit. Verifying data entry (such as cross-checking farmer records with invoices, where applicable), and analysis techniques, ensuring data maintenance and archiving for project time
Additional comments	-

Data/parameter:	Cropland Management Practices$_{PR,y}$
Unit	[dimensionless]
Description	Project scenario Cropland management practices (such as tillage, manure inputs, cover crops) after project start in stratum y
Source of data	Farmer own records
Value(s) applied	-
Measurement procedures	Farmer records
Monitoring frequency	Annually
QA/QC procedures	-
Additional comments	-

ANNEX 1: GUIDANCE ON DEMONSTRATING POSITIVE IMPACT OF BIOSTIMULANT APPLICATION ON SOIL CHARACTERISTICS

Improving soil characteristics is one the possible positive impacts generated through application of biostimulants in combination with other regenerative agricultural practices such as cover cropping, reduced tillage/no-tillage, etc. Where a project activity is to demonstrate improved soil characteristics in the project scenario as compared to baseline scenario, the project activity may use the following as guidance.

The project proponent can select a relevant soil characteristics indicator. Examples of indicators from the Section 6 of the Status of the World's Soil Resources[16] are:

Topic	Example of indicator
Soil erosion	Soil erosion rates (tonnes of soil/ha/year)
Soil contamination	Quantity of soil contaminants such as metallic trace-elements and radionuclides, and organic compounds like xenobiotic molecules (tonnes/ha)
Soil acidification	Surface (0-10 cm) and depth (10-30 cm or lower) pH (dimensionless)
Soil salinisation and sodification	Electrical conductivity of the soil (S/m) or exchangeable sodium percentage (dimensionless)
Soil biodiversity	Presence of macrofauna (number and traces of activity through earthworm sampling) (Number of earthworms per m^3 of soil)
Soil nutrient	Nutrient concentration in soils (such as nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), and sulphur (S)) (tonnes/ha)
Soil compaction	Porosity (mass of carbon/m^3 of soil)
Soil-water quantity and quality	Volumetric Water Content (m^3/m^3)

Monitoring: The project proponent can monitor the soil characteristics indicator at regular intervals such as annually. The following tables present requirements relating to data and parameters for soil characteristics indicators.

[16] Status of the World's Soil Resources. FAO and ITPS, 2015. Available at: http://www.fao.org/3/i5199e/i5199e.pdf

a. Data and Parameters fixed:

Data/parameter:	Cropland Management Practices$_{PR,y}$
Unit	[dimensionless]
Description	Project scenario Cropland management practices (such as tillage, manure inputs, cover crops) after project start in stratum y
Source of data	Farmer own records
Value(s) applied	-
Measurement procedures	Farmer records
Monitoring frequency	Annually
QA/QC procedures	-

b. Data and Parameters Monitored:

Data/parameter:	Soil characteristics$_{PR,j,y}$
Unit	[dimensionless]
Description	Project scenario, Soil characteristics indicator of type j during project scenario in stratum y
Source of data	Soil analysis
Value(s) applied	As per the soil analysis
Measurement procedures	As per the international or national applicable guidelines for the selected soil characteristics indicator j
Monitoring frequency	At every performance certification cycle, preferably annually
QA/QC procedures	As per the international or national applicable guidelines for the selected soil characteristics indicator j

DOCUMENT HISTORY

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1.0	01/11/2023	First release