Climate project methodology № 0003

Changes in soil organic carbon stocks from cropland

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1. Terms and definitions

Climate project (GHG project) – a set of measures ensuring the reduction (prevention) of greenhouse gas emissions or an increase in the absorption of greenhouse gases.

Greenhouse gas project developer (GHG project developer (PDs)**)** – individual or organization that has overall control and responsibility for a GHG project.

Greenhouse gas baseline (GHG baseline) - Quantified reference point(s) for GHG emissions and/or GHG removals that would occur in the absence of the GHG project, expressing the baseline scenario against which project emissions and GHG removals are compared.

Baseline scenario - Hypothetical development reference that best represents the conditions most likely to arise in the absence of a GHG project

Monitoring - Continuous or periodic evaluation of GHG emissions, GHG removals, or other GHG-related data

SOC – Soil organic carbon

IAs - intervention areas

PDs - project developer

DM – dry matter

SOCBL - soil organic carbon in the eligible project area before the project start

SSM – Sustainable Soil Management

GWP - Global Warming Potential for N_2O, kg-CO_2-e (kg-N_2O)$^{-1}$

MW_{N2O} – Ratio of molecular weights of N_2O and N (44/28), tonne-N_2O (t-N)$^{-1}$

MW_{CO2} - Ratio of molecular weights of CO_2 and C (44/12), tonne-CO_2 (t-C)$^{-1}$

SALM - Sustainable agriculture land management

2. Scope and applicability

Cropland management modifies SOC storage to varying degrees depending on how specific practices influence C input and output from the soil system. The main management practices that affect soil C stocks in croplands are the type of residue management, type of tillage practices, fertilizer management (both mineral fertilizers and organic amendments), choice of crop and intensity of cropping management (e.g., continuous cropping versus crop rotations with periods of bare fallow), irrigation management, and mixed systems with cropping and pasture or hay in rotating sequences. In addition, drainage and cultivation of organic soils reduce soil C stocks. Land-use change and management activity can also influence SOC storage by changing

erosion rates and subsequent loss of C from a site. Methodology for the estimation of SOC stocks is based on direct measurements from field samplings. However, the estimate of the future variation of SOC stocks shall be made using SOC dynamic models.

This methodology is applicable to projects that introduce sustainable agriculture land management practices (SALM) into an agricultural landscape subject. SALM involves a holistic approach to achieving productive and healthy ecosystems by integrating social, economic, physical and biological needs and values, and it contributes to sustainable and rural development. Implementing the project, the project scope should include an assessment of CO_2 and N_2O (direct and indirect emissions of N_2O) emissions and met the following conditions:

a) Geographic location:

• Projects are eligible in all regions. Some SOC Activity Modules may be limited by geographic condition, which shall be taken into account as part of the applicability by PDs.

SOC Activity Module includes:

- ✓ Activity-specific applicability conditions, requirements and potential sub-selection of calculation approaches;
- ✓ Activity-specific measurement and monitoring requirements;
- ✓ May be globally applicable or be limited to specific conditions (e.g. soils, climate zones, data availability);
- ✓ May provide activity-specific data sources and/or models to apply (e.g. globally or regionally applicable parameters).

b) Project area:

• As a suitable area for the project are arable fields used for annual crops or fallow lands as well as used for perennial crops, including forage grasses. The project activity shall take place on the same parcel of land as the baseline. Climate project shall be applicable to agricultural enterprise scale in defined intervention areas (IAs). Each IA may involve one or several fields either within one individual farm or on different farms owned or operated by the same or different companies that are part of the same project. If one part of the project area is materially different from another, more than one IA shall be defined due to the increased likelihood of detecting SOC and GHG emissions changes in homogeneous IAs. Material differences in soil type, land use, land-use history and landform all affect SOC stocks and, thus, shall trigger the delineation of separate IAs.

- The project does not occur on wetlands, including drained peatlands.

- The project areas do not occur on forest areas.
- The project territory does not include infrastructure areas on fields.
- The climate project can not be implemented in the abandoned areas of agricultural land subject to plowing.

c) Site preparation:

• No biomass burning for site preparation is allowed in the project.

According to paragraph 185 of Decree No. 1479 of the Government of the Russian Federation dated September 16, 2020 "On Approval of Fire Safety Rules in the Russian Federation", burning of stubble, crop residues and making fires on the fields is not permitted.

d) Water regime:

• Project activities shall not include changes in surface and shallow (<1m) soil water regimes through flood irrigation, drainage or other significant anthropogenic changes in the groundwater table. If the application of fertilizers is expected during the project activity, then it should not be the application of extremely high doses of mineral and organic fertilizers, which can lead to an increase in surface and subsoil flushing of nutrients (nitrogen) into surface and ground waters with further eutrophication of water bodies.

e) Land use:

• Managed cropping systems (e.g. single crop or crop rotation) must have been in place for at least 5 years prior to the project start.

• The project activity shall not lead to land use change.

Croplands at the start of the project shall show the potential for reduce SOM losses or contribute to its accumulation in their soil organic carbon stock after the adoption of SSM practices (compared to baseline of the project), by either gaining or maintaining SOC levels.

f) Food security:

• No reduction in crop yield which can be attributed to the project activity shall be allowed. Activities in the project area shall deliver a yield at least equivalent to the baseline yield (five-year average, prior to the project start). If regional crop productivity changes (e.g. due to climatic factors), yield in the project area shall not decrease significantly (5%) more than yield in the project region.

During the implementation of project activities, a decrease in crop yields is not allowed. Farms should maintain their income from production at least at the level before the start of the

project. In case of changes in crop yields due to external causes (e.g. climate change), the level of yield in the project area should not be significantly reduced (by 5%), compared to the rest of the arable areas of the project region:

Direct impacts on SOC and project emissions:

• Agrochemical inputs, e.g. fertilizer or other nutrient inputs, pesticides, other additives

• Change in hydrology, e.g. due to irrigation, draining and seasonal shift in crop coverage

• Change in crop-related inputs, including plant residue and N-fixation

• Change in technical management of crop (e.g. machine use for planting, treatments and harvest)

• Seasonal change in crop management activities (e.g. harvesting, fallow periods, season without vegetation cover)

Market leakage risks

• Change in crop revenues (outside the normal market price variations)

• Change in crop yield (outside of normal variation) expressed in mass (tons) and with relation to calorific value and end-user (crops for animal/human use).

In case of changes in the GHG regulatory legal framework of the Russian Federation, this methodology is subject to revision in order to take into account the relevant changes.

3. Baseline methodology

The project developer (PDs) should consider all potential baseline scenarios that include the proposed project as a potential baseline scenario.

When developing a baseline, the project proponent must select and justify assumptions, values, and procedures that ensure that GHG emission reductions or GHG uptake increases cannot be overestimated, select or develop, justify, and apply criteria and procedures to demonstrate that the project results to reduce emissions or increase GHG uptake are additive to existing ones compared to the defined baseline.

At the start of the project, PDs shall make the baseline scenario to be determined by identifying conditions:

- ✓ the land use and management practices that were in place during the five years prior to the intervention;
- ✓ regional conditions: the land use and management practices that represent the typical land uses and agricultural management practices.

The identified practices scenario must be realistic and credible on the basis of verifiable information sources, such as reporting of the agricultural enterprise, national or regional agricultural statistics reports, documented public management records of land users, published peer-reviewed studies in the project region, results of surveys conducted by or on behalf of the project developer prior to the initiation of project activities.

The baseline scenario definition is based on the provision of five-year historic activity data to be assessed, including:

- ✓ cash and cover crops per year (approximate sowing and harvest dates), and harvested yields or biomass (kg DM/ha/yr);
- ✓ residue management; assessment of removal and return of residues (percent or kg DM/ha/yr);
- ✓ tillage practices (tillage system, number and type of tillage operations per year) annual mechanized farm operations;
- ✓ tillage, planting, pest control, fertilizer/organic and inorganic amendments/manure application and distribution, harvesting, mowing, baling hay, internal transportation, other operations;
- ✓ fertilizer and inorganic amendment use (product, application method, moment/of application, fertilizer and nutrient doses per year in kg/ha);
- ✓ organic amendment uses (type, form of application, placement method, timing and application rate per year);
- ✓ irrigation annual fossil fuel consumption.

3.1 Estimation of SOC baseline

For each eligible area of the project baseline SOC stocks shall be quantified using the following approaches:

1. Soil organic carbon stock (t C/ha) at 0-30 cm shall be projected SOC simulation models for a 20-year period, using historic and projected activity data as inputs for the model. The baseline based on historical data takes into account periods of biogeochemical cycles of carbon and nitrogen in cropland soils. A minimum projection of 20 years is required in order to allow comparisons and harmonization of different projects. Standardized baselines shall be established at the highest possible level of aggregation in the relevant sector.

SOC simulation models are able to simulate SOC dynamics under different land usage, climatic conditions, and management practices. These include such models as RothC or Tier 2 Steady

state soil carbon method of IPCC (IPCC, 2019 Volume 4 AFOLU, Chapter 5 Cropland) to be applied.

If there is reliable evidence that carbon stocks in soil of project area are in a steady state at traditional practice, then it is only possible to measure average initial soil carbon stocks as a baseline.

2. Soil organic carbon baseline level (SOCBL) content as well as other parameters to initiate SOC models are measured from a representative number of soil samples using national measurement methods.

Baseline SOC stocks are calculated as the sum of projected C stocks multiplied by the area in the time of each monitoring date during crediting period (in 5, 10, 15 years after project activity starts) as shown in Equation 1.

Equation 1

$$SOCBL = \Sigma(SOCBL,y \times Ay)$$

Where:

SOCBL	soil organic carbon baseline level [tC]
SOCBL,y	soil organic carbon in stratum y before project start [tC ha-1]
Ay	area of stratum y before project start [ha]

3.2 Estimation of baseline N_2O emissions

The total amount of N_2O-N emissions of a given farm or installation (kg N_2O-N yr^{-1}) is calculated as follows:

Equation 2

$$N_2O_{total} = N_2O_{direct} + N_2O_{indirect}$$

Where:

N_2O_{total}	total amount of N_2O-N emissions in the project area before project start [t N_2O-N yr^{-1}]
N_2O_{direct}	annual direct N_2O–N emissions produced from managed soils in the project area before project start, including direct emissions from synthetic fertilizers, organic

fertilizers, crop residues and mineralization associated with loss of soil organic matter resulting from change of management of mineral soils [t N_2O–N yr^{-1}]

$N_2O_{indirect}$ amount of N2O-N emissions from volatilization or from leaching and runoff in the project area before project start [t N_2O-N yr^{-1}]

Total baseline stocks of GHG in tCO_2 yr^{-1}:

Equation 3

$$GHG_{total} = SOCBL * MW_{CO2} + N_2O_{total} * MW_{N2O} * GWP_{N2O}$$

4. Terms of the project and project crediting period (if applicable)

For validation, projects can be submitted to the validation and verification body, the implementation of which was started no earlier than 2 years before submission for validation.

Project timeline consists of separate crediting periods. The duration of the crediting period shall be a maximum of 10 years with option of renewal twice. If there is no option of renewal the duration of the crediting period shall be 15 years.

The crediting period shall not start before the registration of the project in the Register of Carbon Units.

5. Additionality

Additionality shall be demonstrated using Tool #1 Demonstration of the additionality of the project activity.

6. Monitoring plan requirements

PDs shall select or establish criteria for identifying sites for regular monitoring or assessment based on suitable and reliable data. PDs of the project shall develop and implement a monitoring plan that includes procedures for measuring, namely, obtaining, recording, summarizing and analyzing data and information necessary to quantify and report changes in carbon stocks in the soil related to the project and the baseline scenario. The PPs shall explain the reason for not selecting a site identified in the baseline scenario for regular monitoring. Soils

sampling is recommended according to the national standard GOST R 58595-2019 approved and put into effect order of the Federal Agency technical regulation and metrology 10 October, 2019 N 954-st. Carbon stock content of cropland is measured from a representative number of soil samples using national measurement methods.

The emissions of N_2O should be estimated according the IPCC Methodology (2006), Volume 4, Chapter 11. In the Russian Federation the methodology of National GHG Inventory Report or the methodology of Approval of the Ministry of Natural Resources and Environment of the Russian Federation of April 16, 2015 N 15-r "Methodological recommendations for conducting a voluntary inventory of greenhouse gas emissions in the constituent entities of the Russian Federation " to be used. It is possible to use direct measurements comparable to the above methods.

PDs shall develop and implement a monitoring plan that includes procedures for measuring, namely obtaining, recording, summarizing and analyzing data and information needed to quantify and report changes in soil carbon and nitrous oxide emissions related to the baseline and project scenario.

Monitoring of the project area on cropland should be conducted every two year or at least every 5 years.

The monitoring plan should include the following, as applicable:

a) The purpose of the monitoring;

b) The list of parameters to be measured and monitored;

c) The types of data and information to be reported, including the units of measurement;

d) Sources of data;

e) Monitoring methodologies, including soil sampling procedure according to available national methodologies and their representativeness, evaluation, modeling, measurement, calculation approaches and uncertainty. The frequency of monitoring, taking into account the needs of the intended users;

f) Roles and responsibilities of participants related to monitoring, including procedures for authorizing, approving, and documenting changes in recorded data;

g) Control procedures, including internal validation of input data, conversions, and output data, and procedures for corrective actions;

h) GHG information management systems, including data placement and preservation, and data management, including procedures for transferring data between different types of systems or documentation.

Where monitoring tools and equipment are used, the PDs shall ensure that they are properly applied, maintained and the requirements of this methodology and are comparable to IPCC or Nation GHG inventory methodologies and approaches.

The PDs shall apply monitoring criteria and procedures in accordance with the monitoring plan. All data and information related to project monitoring shall be recorded and documented.

PDs shall stratify the project area by crop system, tillage system, use of crop residues, application of mineral and organic fertilizers in soils and relevant climatic variables as a minimum.

The soil sampling monitoring program is aimed at detecting soil organic carbon (SOC) concentration and stock changes from an initial baseline condition, to demonstrate that the adopted SSM practices are either increasing or maintaining SOC stocks. Soil bulk density (BD) determinations are required to calculate SOC stocks.

Soil sampling is recommended according to the national standard GOST R 58595-2019 approved and put into effect order of the Federal Agency technical regulation and metrology 10 October, 2019 N 954-st. Carbon stock content of cropland is measured from a representative number of soil samples using national measurement methods.

7. Project scenario

For all of the eligible project area, SOC stocks at time t are calculated as the sum of stocks in each stratum multiplied by the stratum area:

Equation 3

$$SOCt=\Sigma(SOCt,y\times Ay)$$

Where:

SOCt	soil organic carbon in the eligible project area at time t [tC]

SOCt,y	soil organic carbon in stratum y at time t [tC ha-1]
Ay	area of stratum y at time t [ha]

For each eligible area of project SOC stocks shall be quantified using the method of modeling carbon stocks in arable soils with SOM simulation models such as the RothC model or Tier 2 Steady state soil carbon method of IPCC (IPCC, 20194 Volume 4 AFOLU, Chapter 5 Cropland). This model estimates soil organic carbon (SOC) stocks at a depth of 30 cm under a particular management method on cropland. The modeling should consider only biomass input to the soil within the project boundary.

The information recorded will depend on the choice of the type of activity being promoted.

If the activity is improving the use of crop residues PDs should record:

- ✓ Area of each crop (ha)
- ✓ Productivity of each crop (kg/ha)
- ✓ The amount of crop residues (kg/ha)
- ✓ Existing crop residue management practices and their frequency
- ✓ Future crop residue management practices that will be implemented with the project

If the project activity includes improved tillage practices should record:

- ✓ Area under tillage (ha)
- ✓ Type and depth of tillage
- ✓ Existing tilling practices and their frequency
- ✓ Future tilling practices that will be implemented with the project

If the project activity includes ground cover crops should record:

- ✓ Area of ground cover crops (ha)
- ✓ Number and species of ground cover crops
- ✓ Future numbers of ground cover crops that will be implemented with the project

Emissions of nitrous oxide from cropland. The main sources of N_2O:

- ✓ synthetic N fertilizers;
- ✓ organic N applied as fertilizer (e.g., animal manure, crop residues, compost, sewage sludge, rendering waste);
- ✓ N in crop residues (above ground and below ground), including from N-fixing crops (legumes) and from forages during pasture renewal;

- ✓ N mineralization associated with loss of soil organic matter resulting from change of management of mineral soils.

Direct emissions of N_2O come from nitrification and denitrification processes. Indirect N_2O emissions come from nitrogen volatilization and leaching and runoff.

The total amount of N_2O-N emissions of a given farm or installation (kg N_2O-N yr^{-1}) is calculated as follows:

Equation 4

$$N_2O\ total = N_2Odirect + N_2Oindirect$$

$N_2Ototal$ total amount of N_2O-N emissions in the project area [t N_2O-N yr^{-1}]

$N_2Odirect$ annual direct N_2O–N emissions produced from managed soils in the project area, including direct emissions from synthetic fertilizers, organic fertilizers, crop residues and mineralization associated with loss of soil organic matter resulting from change of management of mineral soils [t N_2O–N yr^{-1}]

$N_2Oindirect$ amount of N_2O-N emissions from volatilization or from leaching and runoff in the project area [t N_2O-N yr^{-1}]

8. Leakage assessment

According to the Order of the Ministry of Economic Development of Russia dated May 11, 2022 N 248 project activities should not lead to an aggregate increase in greenhouse gas emissions or reduce their absorption levels outside the scope of such activities.

At the same time, it is necessary to consider and fully account for if project leaks exist in accordance with the methodology below.

As a possible source of leakage as a result of project activities is the potential burning of crop residues outside the project field. According to paragraph 185 of Decree No. 1479 of the Government of the Russian Federation dated September 16, 2020 "On Approval of Fire Safety Rules in the Russian Federation", burning of stubble, crop residues and making fires on the fields is not permitted. If such a spill occurs, it must be fully accounted for in project reporting documents and submitted for inspection.

9. Non-permanence risk analysis

The non-permanence risk on the cropland area is that at the end of the project may return to traditional practices and lose all the accumulated carbon. Therefore, the project implementers must provide guarantees that at the end of the project period the results will last for 100 years. If such guarantees can not be provided, then the number of achieved emission reductions / increased uptake in the project should be discounted commensurately for the number of years that are not covered by the guarantees.

10. Methods to prevent double counting, negative impacts on the environment and society

Double counting of soil C stocks in cropland is possible when the impact of activities is not cumulative, but is calculated using independent approaches (e.g., using separate models or even separate methodologies for estimating C stocks in cropland). To avoid such effects, the methodology should consider the following rules when applying multiple activity to a single project: A project applying direct measurement to at least one activity. For soils with a measured SOC impact, the resulting difference represents the impact of all project activities, i.e., no additional model calculations are performed to increase SOC.

Climate project should demonstrate its compliance with all legal requirements in the jurisdiction where it is located. Project proponent should question whether there is a risk that their project might result in negative impacts for local communities, biodiversity and the environment. Such projects should not cause an increase in atmosphere, soil, surface and ground water pollution as well as lead to any community conflicts, land tenure issues, forceful evictions, human rights violations, or worsened health and wellbeing due to restricted access to a forest or nature area.

The project does not involve and is not complicit in significant conversion or degradation of critical natural habitats, including those that are (a) legally protected, (b) officially proposed for protection, (c) identified by authoritative sources for their high conservation value or (d) recognized as protected by traditional local communities

The project respects internationally proclaimed human rights including dignity, cultural property and uniqueness of indigenous people. The project is not complicit in Human Rights abuses.

11. Update of the baseline at the renewal of the crediting period

At the renewal of crediting period the project is subject to verification with elements of validation and a technical assessment by a validation and verification body to determine necessary updates to the baseline, the additionality and the quantification of emission reductions.

In order to update the baseline, the approach to its definition, the main parameters and assumptions used in the analysis are revised and updated. The baseline shall be representative of the conditions for the beginning of a new crediting period and be valid for that period.

The additionality at the renewal of the crediting period is checked for compliance to the criteria under Tool №1 at the date of the beginning of the new crediting period.

12. Normative references

1. Order of the Ministry of Economic Development of Russia dated May 11, 2022 № 248 "On approval of the criteria and procedure for classifying projects implemented by legal entities, individual entrepreneurs or individuals, as climate projects, the form and procedure for reporting on the implementation of a climate project" (Registered with the Ministry of Justice of Russia on May 30, 2022 № 68642)
2. GOST R ISO 14064-1-2021. National Standard of the Russian Federation. Greenhouse gases. Part 1. Requirements and Guidance for Quantification and Reporting of Greenhouse Gas Emissions and Absorption at the Organization Level (approved and enacted by Rosstandart Order No. 1029-st dated 30.09.2021);
3. GOST R ISO 14064-2-2021. National Standard of the Russian Federation. Greenhouse gases. Part 2. Requirements and Guidelines for Quantification, Monitoring and Reporting Documents for Projects to Reduce Greenhouse Gas Emissions or Increase Their Absorption at the Project Level (approved and enacted by Order No. 1030-st of Rosstandart dated September 30, 2021);
4. GOST R ISO 14064-3-2021. National Standard of the Russian Federation. Greenhouse gases. Part 3. Requirements and Guidance for Validation and Verification of Greenhouse Gas Statements (approved and enacted by Rosstandart Order No. 1031-st of 30.09.2021);
5. GOST R ISO 14065-2014 National Standard of the Russian Federation. Greenhouse gases. Requirements for greenhouse gas validation and verification bodies for their

application in accreditation or other forms of recognition (approved and enacted by Order of Rosstandart of 26.11.2014 № 1869-st);

6. GOST R ISO 14080-2021. National Standard of the Russian Federation. Greenhouse Gas Management and Related Activities. System of approaches and methodological support for the implementation of climate projects (approved and enacted by Order of Rosstandart No. 1033-st dated 30.09.2021);
7. GOST R ISO 14066-2013. National Standard of the Russian Federation. Greenhouse gases. Requirements for competence of greenhouse gas validation and verification groups (approved and enacted by Order of Rosstandart of 17.12.2013 № 2274-st);
8. Order of the Ministry of Natural Resources of Russia dated May 27, 2022 № 371 "On approval of methods for quantitative determination of greenhouse gas emissions and greenhouse gas removals" (from March 1, 2023, except for certain provisions, coming into force on March 1, 2024);
9. Order of the Ministry of Natural Resources of the Russian Federation dated June 30, 2015 №300 "On approval of methodological guidelines and guidelines for quantitative determination of greenhouse gas emissions by organizations engaged in economic and other activities in the Russian Federation" (until March 1, 2023);
10. IPCC 2006. Guidelines for National Greenhouse Gas Inventories of the Intergovernmental Panel on Climate Change, 2006 / Edited by S. Iggleston, L. Buendia, K. Miwa, T. Ngara and K. Tanabe. // T.1-5. - IGES// Hayyam. 2006.
11. VCS Methodology VM0017 v 1.0 (2011): Adoption of Sustainable Agricultural Land Management. Developed by BioCarbon Fund, World Bank. (https://verra.org/methodology/vm0017-adoption-of-sustainable-agricultural-land-management-v1-0/)
12. VCS Module VMD0021 v1.0 (2011): Module VMD0021 Estimation of Stock in the Soil Carbon Pool. (https://verra.org/methodology/vmd0021-estimation-of-stocks-in-the-soil-carbon-pool-v1-0/)
13. 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

14. Global Standard for the Global Goals Soil Organic Carbon Framework Methodology Version1.0 https://globalgoals.goldstandard.org/standards/402_V1.0_LUF_AGR_FM_Soil-Organic-Carbon-Framework-Methodolgy.pdf
15. 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Volume 4 Agriculture, Forestry and Other Land Use (https://www.ipcc-nggip.iges.or.jp/public/2019rf/vol4.html)
16. Decree of the Government of the Russian Federation of 16.09.2020 No. 1479 (revised on 24.10.2022) "On Approval of the Rules of the Fire Prevention Regime in the Russian Federation" https://docs.cntd.ru/document/565837297.