Value Change

VALUE CHAIN (SCOPE 3) INTERVENTIONS - GUIDANCE FOR SOIL ORGANIC CARBON

To be read in conjunction with the Value Chain (Scope 3) Interventions – Greenhouse Gas Accounting & Reporting Guidance

Draft Version for Consultation

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INTRODUCTION

Reducing the pressure on already degraded or non-agricultural land requires an increase in sustainable productivity. Currently, around 52% of agricultural lands are medium- to severely degraded, meaning that they do not have optimum soil organic carbon level for production. Annually, around 10 million hectares of agricultural soils are lost (FAO and ITPS 2015), despite many technical and economically viable approaches that enable the restoration of such degraded soils and restore their agricultural production capacity. For example, productivity can be restored through sustainable land management methods, including soil and water conservation, building soil productivity through improved nutrient cycling, use of organic matter (manure, compost, litter) and fertilizer, integration of livestock in crop production systems, agroforestry, reduced tillage and improved fallows.

It is estimated that sustainable soil management practices and rehabilitating degraded soils could sequester 15% of annual global GHG emissions (IPCC 2014). Carbon sequestration in agricultural soils is therefore very important for climate change mitigation, while at the same time enhancing productivity, resilience and ecological soil health functions.

In the context of agricultural supply chains, this can restore and build resilience in vulnerable or degraded areas, supporting local farmers and dealing with the challenges of remote or difficult-to-access suppliers. This Guidance document provides the guiding principles and approaches to establishing and reporting agriculture supply chain interventions in the context of Soil Organic Carbon (SOC).

Setting and reporting greenhouse gas performance targets in agricultural supply chains is challenging. In many cases these supply chains are deep and complex, while traceability and accuracy of data can be limiting factors. Many companies reporting their emissions may seek to employ 'interventions' in their supply chains; projects, programmes and business decisions that drive sustainability and reduce emissions in key areas.

This Guidance, in conjunction with the Value Chain Interventions Guidance, provides an overall process for defining an intervention, choosing a monitoring approach and

accounting method, applying these methods post-implementation and including the results in Scope 3 reporting.

APPLICABILITY & OVERVIEW

This Guidance document (henceforth 'Soil Guidance') is intended to be read alongside the Value Chain (Scope 3) Interventions Guidance (henceforth 'Interventions Guidance'). The Soil Guidance document is supplementary to Interventions Guidance, which in turn is supplementary to the Scope 3 Standard and Greenhouse Gas Protocol Technical Guidance for Calculating Scope 3 Emissions (henceforth the Scope 3 Guidance).

This Guidance, in conjunction with the above documents, aims to raise ambition by providing an approach through which value chain interventions are incentivized by enabling their recognition and inclusion in reporting towards performance targets, even in cases where direct knowledge and measurement of specific value chains is challenging. This is especially true of agricultural supply chains and interventions involving SOC.

Through the application of the Soil Guidance, in the context of the Interventions Guidance, a company will be able to:

1. Identify appropriate SOC interventions and design/select appropriate monitoring approaches and accounting methods for their before and after scenarios

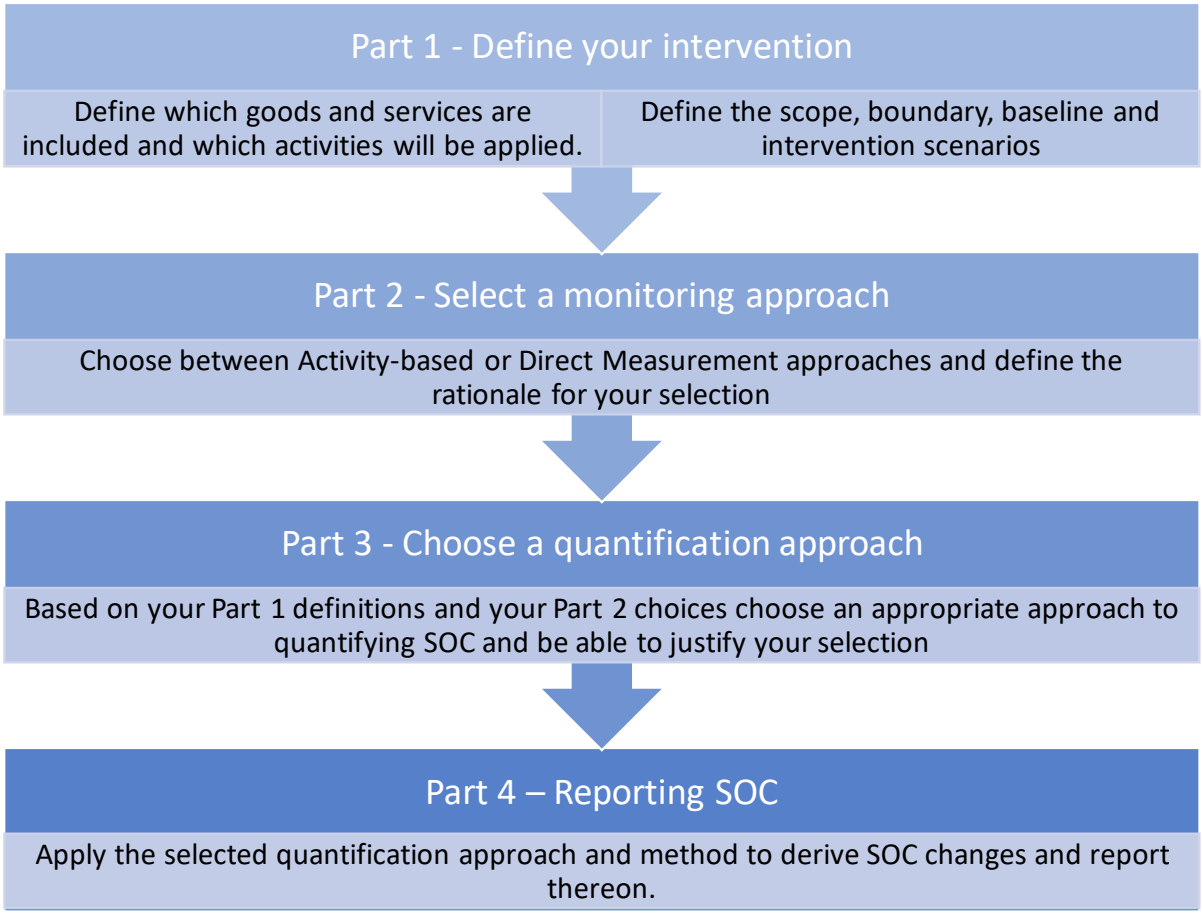
2. Account for the net removal changes associated with a given SOC intervention

3. Credibly report on the results of the intervention alongside the company's Scope 3 inventory and reporting, where appropriate

4. Make narrative claims concerning the company's role in the intervention and the impacts arising from it

The Soil Guidance is arranged to first facilitate a decision on which approaches and methods a company could apply to quantify and monitor SOC. It then provides further guidance on each approach, as well as recommend relevant tools, protocols and methodologies. Finally, the document details how to apply numbers generated in relevant equations in the Interventions Guidance (Figure 1).

Figure 1: Process flow for Soil Organic Carbon Guidance for accounting and reporting



WHO SHOULD USE THIS GUIDANCE?

This Soil Guidance is aimed at any company with a Scope 3 emissions reduction target that seeks to account for interventions that impact total net SOC associated with purchased goods and services. The Interventions Guidance provides further detail about where this is most relevant and applicable.

The Soil Guidance sets out a step-wise process that assumes an intervention has not yet been implemented. In reality, many users will have interventions that are already underway, at various stages set out in Figure 1. In such cases, the Soil Guidance can be used to review the approach underway retroactively and to understand any gaps in the rationale and justification for the approach chosen.

It is noted that this Soil Guidance provides recommendations and methodological references to already existing and best practice tools, methods and information. It does not present a new SOC accounting method but rather compiles existing methods and guidance. References are not exhaustive; the methods and tools 'landscape' will evolve further. New methods, parameters (for example those included in the revised report[1] to the current 2006 IPCC inventory guidelines), tools and technologies can be applied under this Soil Guidance providing the quality and quantification approaches meet the guidelines outlined in the following chapters.

[1] The "2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories" report will be considered by the IPCC for adoption/acceptance at its Plenary Session in May 2019.

PART ONE – DEFINE THE INTERVENTION

This section describes the key elements used to define any given SOC intervention. The process is important because it aligns the intervention with the Interventions Guidance and provides the basis from which appropriate monitoring and measurement methods can be selected.

As the assumed purpose of the intervention is to enhance climate mitigation through In line with the approach set out in the Scope 3 Standard and the Interventions Guidance, changes in the SOC pool are calculated by multiplying the volume of goods by a SOC emissions factor (EF_{SOC}). This section helps define what is included in and what is excluded from SOC intervention accounting.

The intervention scope can be defined by decisions in the following main areas:

- The inclusion or exclusion of specific activities or practices, on the basis of their likelihood and the significance of their SOC impacts (both positive impacts such as SOC sequestration as well as negative impacts, e.g., emissions from fertilizer use), and their measurability (i.e., quantifiability and data availability)

- The geographical and process boundary of SOC impact assessment, including stratification along soil gradients, climate zones and land management practices

- The time period for SOC accounting

- Soil depth for SOC impact assessment

Changes to supply chain SOC caused by an intervention result from the difference between the EF_{SOC} for the supply prior to the intervention and after the intervention.

Equation 1:

$$\Delta SOC_y = \text{Quantity of Goods Purchased} * EF_{SOC}$$

Where:

- ΔSOC_y = SOC change in a given year associated with the production of purchased goods and services(tCO_2e)
- EF_{SOC} = SOC Emissions Factor (e.g. tCO_2e per unit, volume or mass of product)

The following process guides defining the intervention:

Step 1: Identify targeted goods and services

Per the Interventions Guidance, the reporting company should first identify the purchased goods or services that are to be targeted under the intervention. Under the Greenhouse Gas Protocol, only those interventions that affect goods and services that are being purchased or can be reasonably assumed to be potentially purchased by the reporting company can be included.

Output: Company able to state which goods and services are targeted by the intervention

Step 2: Define the Intervention Scenario

The scenario under an intervention represents the intended inputs, activities and outcomes of the interventions. The intervention scenario should be described for all relevant activities under an intervention impacting the soil organic carbon pool in line with the steps outlined under 'Select and define the scope of SOC assessment' above.

Interventions can refer to a single change or to a package of different activities (basically field practices) implemented within a farm or larger organizational boundary.

Potentially, there are many different practices that affect the SOC pool that could be employed and for which this Soil Guidance applies. Table 2 provides a non-exhaustive list of practices that affect the change of SOC. The table also lists realistic baseline conditions for these practices as well as broad benchmark ranges of SOC impacts. The user should assess, in line with the above, which activities are inside the Scope 3 boundary and which are outside. These should be presented clearly such that they can be used correctly and transparently for accounting purposes.

Table 1: Examples of typical baseline conditions and possible intervention practices affecting soil organic carbon including mitigation benchmarks

Source: adapted from Paustian et al. 2016, benchmarks from Paustian et al. 2016 and Griscom et al. 20017

Typical baseline conditions	Intervention practices	Benchmark SOC impacts (tCO_2e/ha/year)
Native (unmanaged) forests and grasslands	Avoiding conversion and degradation of native ecosystems	- 1.8 - <7.3[2]
Degraded or marginal land	Convert to perennial forest or grassland systems	Up to 2.9[3] for afforestation 2.0 for grasslands[4]
Drained, cropped organic soils	Restore wetland	0[5]
Unsustainable grazing	Optimal grazing intensity	0.2
Degraded pastures	Nitrogen-fixing species in pastures	2.1
Intensive tillage	Reduce or halt tilling, implement residue retention	1.2
Low residue crops	Perennials in croplands[6] - Windbreaks - Alley cropping - Natural regeneration	1.5 0.7 4.4[7] 1.5
Severe nutrient deficiency Extensive bare fallow Degraded agriculture land	Conservation Agriculture or Sustainable Agricultural Land Management	1.2
Available exogenous organic amendments	Add amendments such as compost and biochar	0.7

Where an intervention includes activities impacting on SOC that are outside the Greenhouse Gas Protocol boundary, for example, for areas where the targeted goods and services are not being grown, these may still be quantified in line with this Soil

[2] The minus refers to avoided emissions from SOC

[3] Based on the A/R Methodological Tool 'Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities' (link)

[4] Conant, R. T., Paustian, K. and Elliott, E. T. (2001), GRASSLAND MANAGEMENT AND CONVERSION INTO GRASSLAND: EFFECTS ON SOIL CARBON. Ecological Applications, 11: 343-355

[5] Due to controversy in the literature about the timing and net atmospheric effect of methane emissions in restored peatlands, sequestration benefit from peatland restoration assumed 0

[6] This also includes rotation of perennials, use of agroforestry, and use high-C input species, cover crops

[7] This also includes the carbon within the trees

Guidance but should be scheduled separately (as they cannot be reported under the Greenhouse Gas Protocol).

Useful for assessing what is included under the Greenhouse Gas Protocol is the World LCA Database, particularly Figures 2 and 3. As a general rule, any activity that is related to the production of the targeted goods and services and that takes place on the same land as the production for a given year (or part year) would be considered included in the Scope 3 boundary. Anything outside this can be quantified but not included in the Scope 3 accounting under the Greenhouse Gas Protocol. Further guidance may also be drawn from ISO 14040 and 14044, which consider the relevant boundaries for product accounting.

Output: Company states the range of activities included under the intervention and schedules out which are affecting SOC that may be included under the Greenhouse Gas Protocol and which may not.

EXAMPLE: An intervention could refer to the adoption of conservation agriculture within a cash crop production system, a combination of reduced tillage plus organic inputs to the soil (e.g., through residue retention or use of cover crops, planting of soil fertility trees, etc.) all affecting the SOC pool as well as the goods (cash crop) of the supply chain. Or, the intervention could refer to only reduced tillage as a single practice.

Step 3: Define a Baseline scenario

The baseline scenario represents the land use and management practices that were in place immediately prior to the intervention, or within a reasonable timeframe (i.e., in which data that can be used for this purpose is available). Ideally, the baseline year should be the same as the corporate inventory baseline. Since this Guidance focuses on practices affecting the SOC pools, the baseline must represent the practices and land uses in place at that time.

The approach to characterizing the baseline depends on the availability of data and judgment as to its quality. A key principle is that the baseline should be conservative. Related to soils and SOC, a baseline is conservative if the land uses and practices identified prior to the intervention do not lead to an underestimation of SOC in the baseline.

The following approach is recommended to derive the baseline:

Objective: The baseline should represent the typical agricultural management practices and other land uses (prevailing practices) which are dominant within the larger intervention region or specific intervention areas prior to the start of the interventions.

1. Use a standard land use and farming classification system to define the prevailing systems in a standardized way. This will also allow transparent comparison of interventions under the Scope 3 Standard, independent from their specific geographic locations. Table 2 provides links to widely used classification systems. Interventions in data-rich countries should use classification systems derived in the respective countries.

Table 2: Links to standard land use and farming classification systems

Type of classification	Links
Land use classification systems	- GlobeLand30 (Link) showing land cover 2000 and 2010 - Global Forest Watch (Link) allowing various assessment of tree and forest cover, change of forest cover as well as showing the global distribution of land cover in 2015
Farming systems	- FAO Farming Systems (Link) defined for Sub-Saharan Africa, Middle East and North Africa, Eastern Europe and Central Asia, South Asia, East Asia and Pacific and Latin America and Caribbean

2. Gather data to identify prevailing practices. The analyst could gather data to identify prevailing agricultural or other land use management practices using one of the two options below. The choice of the approach used should be justified.

    - Option 1: Design and conduct a representative baseline survey specific to the intervention area(s) to identify typical management practices applied in the farming/ land use systems identified in Step 1. An activity baseline and monitoring survey guideline is provided as supporting documentation to this guideline.

- Option 2: Use existing data (own or from a third party) to identify prevailing management practices in the intervention area. The existing survey should be current, or at least within a timeframe of 2-3 years prior to the start of the interventions.

Option 1 is recommended for the Activity-based estimation/modelling accounting approach since such a survey can be used to provide information needed to understand the baseline land management and to derive input values which are needed for some of the models. The initial SOC can be derived from available databases (Table 3), such as the recently published FAO Soil Carbon Map. Since Option 2 might not be tailored directly to the specific method selected, this approach is more suitable for the second SOC accounting approach – direct-measurement through soil sampling – since only a broader description of the baseline conditions is required. This is further discussed in Part Two. For definition purposes,it is enough to broadly assess which option is most feasible and appropriate for the user and circumstances of reporting.

3. The credibility of baselines can be strengthened by transparent documentation of underlying assumptions and provision of clear justifications. Consultation with relevant experts and stakeholders can help to ensure that the assumptions underlying the baseline are reasonable. Sensitivity analysis can help identify key factors with significant impacts on the baseline conditions and aid in identification of a conservative baseline.

Output: Company selects an option for defining the baseline scenario, based on data availability and practicality. This choice will later also inform the selection of monitoring approach, in Part Two of this Soil Guidance.

Step 4: Define the geographic and facility boundary for SOC impact assessment

The Interventions Guidance requires the identification of the location (e.g., region) of implementation of that intervention and the facilities (e.g., farms) on which it is to be applied. This helps to ensure that only goods and services that are within the 'supply-shed' of the company are captured and sets the conditions for selecting appropriate monitoring approaches and quantification methods.

Generally, a distinction should be made between the area in which direct SOC impacts will be accounted for as a result of the intervention, and the areas in which spill-over effects occur due to knowledge diffusion. This can be explained by the Interventions Guidance supply shed definition.

Example: A company has plans to support dairy farms within their supply chain in locations A, B and C within district 1. Farms in A, B and C (supply chain farms) are identified as the area in which direct SOC impacts will occur as result of a package of different activities and practices which impact (increase) soil organic carbon. The locations of these farms and information on the area of implementation must be documented. Neighbouring farms D, E, F and G (supply shed farms), which currently are not in the supply chain, are identified as farms where spill-over effects due to knowledge diffusion are likely to occur, while other locations in the district are excluded from the scope of assessment on the basis that these spill-over effects are not directly within the company's Scope 3 boundary (though the company may still wish to quantify these impacts for the purposes of communicating about the overall impact of the intervention).

One outcome of this step should therefore be that the geographical scope of assessment of direct spill-over SOC impacts has been clearly identified. The source of information for identification of the geographical area, and where relevant, any assumptions used in identifying the geographical area, should be transparently documented. It is good practice to document the following information, preferably presented as GIS vector layer (shp) or Google Earth (kml/ kmz) file. The use of simple smartphone open source applications allows cost-efficient tracking of boundaries:

- Broader intervention region: A map with a polygon reflecting the outer boundaries within which different areas (e.g., farms) both with direct and spill-over SOC impacts from the intervention occur.

- Intervention location: A map with one GPS point per intervention location (e.g., farm field) or a polygon for each intervention area.

Where multiple interventions are applied, for example, across multiple farming regions, then the broader intervention region should be selected in way to represent the regional baseline.

Output: Company is able to articulate the geographic and facility boundaries.

Step 5: Define Stratification

The definition of the geographical boundaries of the SOC intervention assessment has implications not only for the scale of interventions and field practices assessed, but also for the quantification of their specific impacts on SOC changes. The application of both approaches presented here, Activity-based and Direct-measurement, can vary by climatic region, soil type and other spatially distributed factors like type of vegetation or land management.

Intervention analysts should input information on the location, climate type and dominant soil type in the intervention area. This means that the definition of the geographical location of the intervention area(s) should be sufficiently precise to enable characterization of climate types and dominant soil types within this area.
Table 3 provides a non-exhaustive list of useful information to support a standardized identification of soil relevant stratification.

Table 3: Databases and information sources to support standardized stratification of the interventions location(s)

Information	Description	Reference and link
IIASA[8]/ FAO Global Agro-Ecological Zones	Version 3 - an integrated crop-specific grid-cell databases reflecting climate data analysis and compilation of general agro-climatic indicators, crop-specific agro-climatic assessment and water-limited biomass/yield calculation, assessments of yield reduction due to agro-climatic constraints, and implementation of edaphic assessments to calculate yield reduction due to soil and terrain limitations	The database can be accessed here (registration required): Link

[8] International Institute for Applied Systems Analysis

Soil data	Location specific topsoil as well as subsoil information available from this application where even a shapefile can be uploaded to match with a specific intervention location	Harmonized World Soil Database v 1.2[9]: Link
Soil data	Web app that provides free access to soil data across borders	ISRIC – Global Soil Data Facility: Link
Soil data	Provides a selection of standardised/ harmonised soil data	The World Soil Information Service (WoSIS) Link
Soil carbon map and data	Best available web-based application to derive intervention location specific SOC stock information	FAO: Global Soil Organic Carbon Map (Link) (GSOC)
Climate data	Different databases available to retrieve climate data, such as monthly temperature, precipitation, etc.	Climate Data Online (National Centers for Environmental Information (NCEI)) Link LocClim: Local Climate Estimator (FAO) Link
Climate data	Very large repository of dataset sorted by themes	NASA (Link)
Climate data	Gives monthly gridded data on temperature and precipitation at global scale	Cru (Climate Research Unit) database (link)
Crop calendar	Important information to understand typical baseline as well as intervention cropping systems; provides country-specific agro-ecological zones	FAO crop calendar (Link)

If there is a relevant reason not to use specific sources as listed above, the following IPCC stratification for national GHG emission estimation parameters and categorization (tier 1) could potentially be applied (Table 4), though is not recommended without a significant reason to do so. This approach is not generally considered to be good practice but is included for completeness. If applying this approach, a corresponding uncertainty must thus be considered and transparently reported and users should be aware of the potential for criticism.

[9] FAO/IIASA/ISRIC/ISSCAS/JRC, 2009. Harmonized World Soil Database (version 1.2). FAO, Rome, Italy and IIASA, Laxenburg, Austria

Also note that a new revision of the 2006 IPCC Guideline is expected in May 2019.

Table 4: 2006 IPCC Guideline tier 1 stratification approach

Information	Description	Reference and link
IPCC Stratification	For national (Tier 1) GHG emission estimation methods; A corresponding uncertainty must be considered	2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Agriculture, Forestry and Other Land Use Climate: Annex 3A.5 of the Link Soil: Annex 3A.5 of the Link Biomass: Figure 4.1 of the Link The FAO Ex-Act Tool has developed useful 'help' application based on the IPCC stratification (Link)

The source of information for identification of the geographical locations and areas, and where relevant any assumptions used in identifying these locations and stratification, should be transparently documented. Stratification also becomes relevant during impact measurement to identify strata with homogenous conditions of SOC change which will reduce any survey or sampling efforts.

Output: Companies are able to clearly define the geographical and supplier boundary of the intervention, what is included within and what is to be scheduled separately as 'spill-over' and how to stratify the Activity-based approach on what is being included.

Step 6: Define time period for monitoring and reporting

The SOC impacts of an intervention may occur during the implementation period and/or after completion during a post-intervention period. In addition, the nature of the intervention and the implemented field practices may also determine the appropriate duration of the SOC monitoring period to best support accounting and reporting.

Table 5: Guiding questions to identify the appropriate time period for SOC assessment

Source: Guidance for Standardized GHG Assessment of Agriculture, Forestry and Other Land Use (AFOLU) Projects. (FAO, 2016)

Question	Responses		
	Yes	No	No guidance
Does the company policy explicitly require quantification of SOC assessment only during the intervention implementation period?	Select intervention implementation period	(proceed)	(proceed)
Do the intervention outputs or outcomes have a defined lifetime period?	Select lifetime period	(proceed)	–
Can a time period be defined after which assumptions affecting the baseline scenario can no longer be reasonably justified?	Select time period in which assumptions are likely to hold	(proceed)	–
Is the answer to all of questions 1-3 'no'?	Use a default period	–	–

In addition to planning the monitoring period for the intervention, companies should also consider their approach for once equilibrium is achieved (i.e. when SOC gains are at their maximum). As SOC may be lost through changes in activity or reverting to previous practices, it is important to continue to monitor that the practices that led to the SOC gains are in place. Companies should therefore plan for monitoring beyond the period of the intervention and should not assume SOC increases are permanent. This could be done with a simpler monitoring approach however, for example based only on whether the activities and practices are still continuing.

Output: Companies should be able to define the temporal scope of the assessment.

Part One Summary – Defining the Intervention

With the application of the process of Part One of the Soil Guidance, a company should now have:

- A clear statement of which purchased goods and services are targeted

- An ‘Intervention Scenario’ list of activities included within the intervention that is categorised by those that are within and those that are outside the Greenhouse Gas Protocol boundary
- A Baseline Scenario option that is appropriate and achievable (this will be revisited in Part Two, dependent on the monitoring approach chosen)
- A defined geographic and facility boundary
- A schedule of the different strata included within the intervention

With these definitions completed, the information can be used to select both a monitoring approach (Part Two) and quantification method (Part Three).

PART TWO: CHOOSE BETWEEN ACTIVITY-BASED OR DIRECT-MEASUREMENT REPORTING APPROACHES

Having established a clear intervention definition, it is now possible to select an approach to monitoring. In this Guidance, two principle monitoring approaches are presented for deriving this SOC change:

1. **Activity-based approach:** Activity-based Impact Factor approaches can be derived prior, or close to the start of the intervention, as long as the packages of activities affecting the SOC can be clearly defined at this stage. During the phase of the intervention's activity (e.g., 5-20 years), monitoring focuses only on the performance of the activities and how well these are implemented and adopted compared to the initial assessment. Direct-measurement of SOC does not occur post-implementation of the intervention.

2. **Direct-measurement approach:** Direct SOC measurements follow the clear ex-post monitoring logic of the IPCC carbon stock change approach, wherein inventories of the SOC stocks prior and after an intervention is determined and the change reflects the impact of an intervention. This approach has the advantage that a package of different practices does not necessarily have to be defined in detail in terms of their impact on SOC since the sampling of the SOC stocks over time allows the absolute changes irrespective of the individual impacts of practices or combinations of them. In addition, this approach allows achievement of higher levels of accuracy since it can better accommodate (i.e., as a part of the sampling design) the high spatial variability of SOC.

It is noted that some companies may also wish to apply a 'hybrid' approach, wherein for example, the intervention applies Direct-measurement for a period, followed by a period of Activity-based measurements. This may be useful where greater certainty is required, but once this is achieved, a more practical approach to continue reporting is preferred.

The following steps are provided to assist companies in choosing between the two options.

Step 1: Choose between Activity-based or Direct-measurement approaches based on the needs of the reporting company

While there are pros and cons to each option, the choice of which approach to apply ultimately depends on the needs and issues faced by the reporting company. Factors include cost, practicality, availability of information and capacity of the company reporting.

Output: Company should be able to justify their chosen approach (Activity-based, Direct-measurement or a hybrid) based on the particular circumstances and aims and objectives of their intervention. This can be updated in future, should a company wish to switch from one approach to the other, or integrate sampling across a number of interventions.

Step 2: Re-assess the Intervention Scenario

Part One provided guidance to support an initial decision on baseline definition selection. Depending on whether Activity-based or Direct-measurement approach was selected, there may be a need to review the Baseline Scenario definition, as follows:

Activity-based Impact Factor Approach: The description of activities under an intervention need to be more detailed since the impact on SOC and its changes is directly linked to the change of activities in the baseline and the intervention scenario. Therefore, as a rule for each specific baseline activity (or practice) identified within an intervention area, a realistic project activity must be defined (even if the activity does not change) and vice versa (for each specific activity under an intervention a specific baseline activity should be defined). Table 6 describes activity examples that are all implemented within the same intervention areas.

Table 6: Example baseline and intervention activities identified within the intervention areas – climate smart coffee

Baseline activities	Intervention scenario activities
Coffee grown without shade trees	Planting of long-term shade trees
Coffee with low yield due to degraded soils	Inter-planting of leguminous soil fertility trees within the first years to increase soil fertility due to Nitrogen-fixing as well as use of tree mulch from regular coppicing

Coffee with low levels of fertilization using inorganic fertilizers	Introduction of composting units providing organic fertilizer
Coffee commonly intercropped with other crops, therefore full tillage between coffee plants	Switch from annual to other perennial crops (including the soil fertility trees), therefore switching to reduced tillage practices

Table 6 provides a simple introduction to the pair-wise comparison of the activity titles. In practice, more specific information is required for each of those to describe these activities in detail, e.g., number of trees planted, yield of coffee under baseline and expected yield under intervention, fertilizer and compost application rates, yields of crops intercropped, etc.

With the help of this exercise, activities that need to be monitored throughout the intervention should be identified. The adoption rate of these activities (what percent of the intervention areas these practices are being implemented) should be assessed. Also, to what degree the activities in the field reflect the optimal application designed and trained for this intervention should be assessed, for example, determining whether the composting monitored in the field is the same quality and with the same application rates as defined as optimal for this intervention.

Direct-measurement Approach: The pair-wise comparison of all baseline and intervention activities does not require the level of detail as for the former approach since the Direct-measurement will assess the impacts on SOC collectively over time, not for each single practice. However, it needs to be documented that any change in SOC measured can be directly linked to the change of activities within the areas.

Output: The original baseline definition option can now be firmed up and greater detail provided. Any required adjustments can be completed.

Part Two Summary – Choosing a monitoring approach

With the application of the process of Part Two of the Soil Guidance, a company should have:

- A preferred monitoring approach (Activity-based or Direct-measurement) and strong rationale for the decision
- A revisited baseline definition based on which approach was chosen

A company now has enough information to determine a suitable quantification approach, as described in Part Three.

PART THREE: SELECT A QUANTIFICATION METHOD

Having established which general approach to quantification is to be applied, a company will also need to select the specific quantification method to be used. There are a huge variety of possible tools that could be chosen. This choice depends on the particular needs of the company and on the monitoring approach selected in Part Two.

There are commonalities to this section that do not change whether Activity-based or Direct-measurement was selected in Part Two. The steps included are intended to provide enough information to design a quantification approach tailored to the needs of the reporting company.

This Soil Guidance does not prescribe or advocate one method over another, but rather provides guidance on how to assess them and justify the choice made.

Step 1: Assess SOC scope and materiality

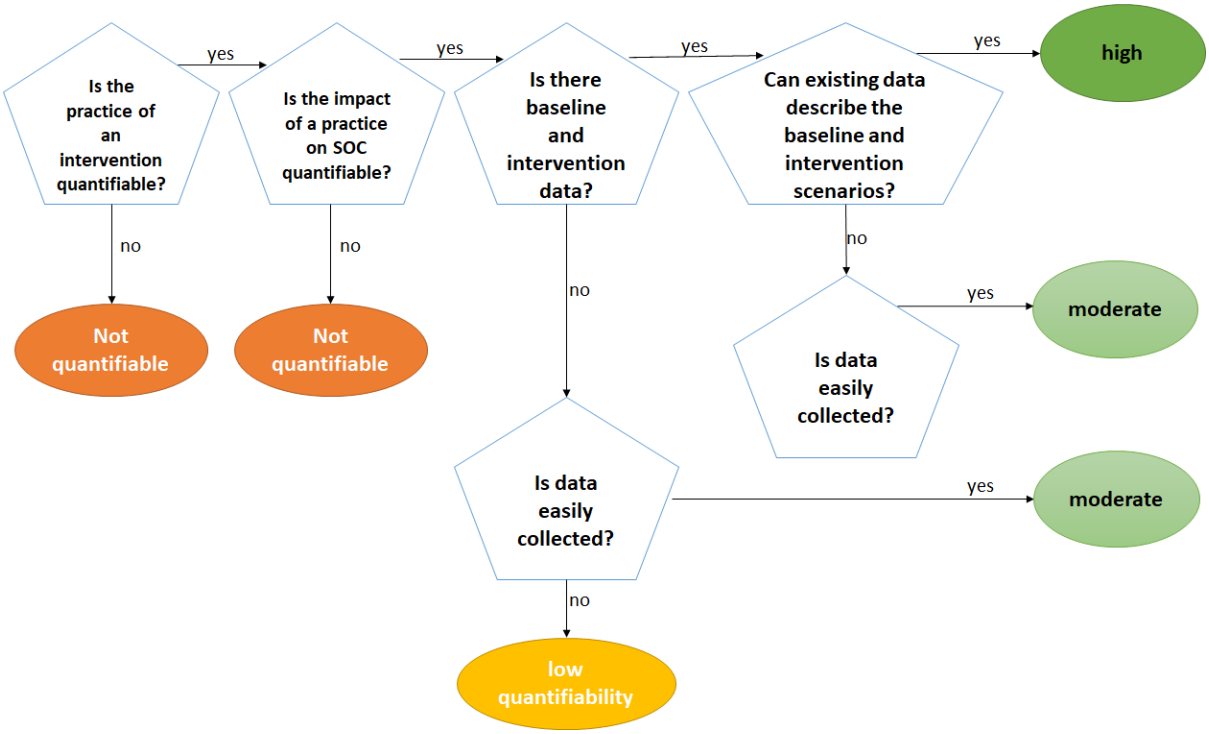
Having earlier established what goods and services are targeted and what activities are included in the intervention, the purpose of this step is to exclude from the SOC assessment practices those that cannot reasonably be represented or that are not sufficiently likely or significant to include in the SOC assessment. In turn, this ensures that the company applying the Soil Guidance chooses a quantification method that includes the scope of activity targeted.

Note that this step is included in the initial definition of an intervention but may need to be repeated under Step Three. In that Step, companies select their method of quantification and this is inevitably based on how well different methods capture the different activities included. A note on this reassessment is included in Step Three.

The chart below presents a decision tree that enables companies to characterize the measurability of potential SOC impacts for any given intervention, in the baseline as well as post-implementation. The outcomes are categorised as ‘high’, ‘moderate’, ‘low’, or ‘not quantifiable’.

Figure 2: Decision tree to assess the measurability of potential SOC impacts of practices

Source: Adapted from Bakker et al. 2010



For outcomes with moderate or low measurability, analysts will have to decide whether to exclude them from SOC. Any inclusions and exclusions on grounds of measurability should be transparently documented during this process. This decision should be consistent in both baseline and intervention accounting.

Secondly, even if an intervention's effects on SOC can be measured, some possible effects may be too uncertain or not sufficiently significant in magnitude to warrant quantification. For the purposes of this guidance, a GHG effect is defined as 'minor' if it accounts for <1% of the expected absolute change in emissions due to the intervention. A GHG effect is of 'moderate' significance if the effect is 1-10% of absolute change in emissions. 'Major' effects account for >10% of intervention's net GHG emissions.

Minor SOC effects may be excluded from the assessment if the total of excluded negative effects does not exceed 5% of total change. To identify some minor SOC effects, analysts should refer to existing relevant literature (e.g., studies from similar geographical areas) or previous SOC assessments and related publications. As benchmarks, Table 2 provides global approximations for different intervention practices. These and most values in literature are given on area basis and therefore need to be

converted to the production of goods in order to assess the significance within a specific supply chain.

Finally, some SOC effects identified in the previous steps may be considered to be possible but unlikely to occur. All intended direct SOC impacts (positive as well as negative) of an intervention should be included. For unintended and indirect positive effects on SOC changes, that are possible but are thought to be most likely not to occur, and effects that probably will not happen, these may be excluded from the SOC accounting and overall assessment. Negative effects with moderate and major significance, even if their occurrence is unlikely, should be included unless mitigation and monitoring strategies for the potential occurrence are in place and documented. The Information on the likelihood of particular SOC impacts may derive from a variety of sources including consultation of experts. Sources of assumptions about the likelihood of an intervention effect on SOC should be transparently documented.

The recommended scope of SOC assessment in terms of the significance and likelihood is illustrated in Table 7, which also presents definitions of criteria for likelihood.

Table 7: Recommended scope of SOC impact assessment based on assessment of significance and likelihood of effects on GHGs related to soil management

<table>
<tr><th rowspan="2">Likelihood</th><th colspan="3">Significance</th></tr>
<tr><th>minor</th><th>moderate</th><th>major</th></tr>
<tr><td>Likely
(may or will probably happen;
probability ≥33%)</td><td rowspan="2">May exclude for both negative and positive effects</td><td colspan="2">Should include for both negative and positive effects</td></tr>
<tr><td>Unlikely
(will probably not happen;
probability <33%)</td><td colspan="2">May exclude for positive; should include for negative effects unless mitigated</td></tr>
</table>

Output: Company has an initial assessment of which SOC pools to assess that can later be used (Step Three) to select or design a quantification method.

Step 2: Review soil depth

Soil depth is an important consideration in the assessment of SOC because large SOC stocks and persistent organic matter exist in subsoils. While the 2006 IPCC Guidelines

require assessment only to a depth of 30 cm, current research indicates relevance of deeper layers (50 cm), especially when interventions include tillage change. It is important, therefore, to give sufficient attention to how management practices can increase SOC in deeper soil layers and how SOC can be assessed efficiently (FAO 2017).

It is noted that in the case of selection of Activity-based measurement (see Part Two), data availability is typically limited to 30 cm depth and hence this becomes a default selection. In future, as more data becomes available and of better quality this may change.

To determine SOC stocks and SOC changes, analysts shall quantify within a specific soil sampling depth reflecting the site-specific soil conditions as well as the effects of the interventions on the different soil layers (soil depths). The results of SOC change should be reported for a soil depth as deep as changes are expected from the intervention or at least for 30 cm. Appropriate error and uncertainty should be reported.

Output: Determination of soil depth and whether this is included within the scope of the method.

Step 3: Consider other emissions

GHG emissions may occur during an intervention that are directly linked to some of the activities implemented. This includes, for example, emissions from increased use of fertilizer (inorganic and organic) or pesticides, emissions from increased use of fossil fuels and under some circumstances emissions from soils. Most of the proposed tools and methods also provide guidance on how to account for other emissions. In these cases, analysts should follow the specific guidance given in the respective documents.

Emissions should only be accounted for, that is, deducted from the SOC impact factor, if total emissions from other sources caused by the intervention exceed 5% of SOC change in a given year associated with the purchase of goods and services. The tools in Table 8 provide simple default methods to assess the different emission sources in case no other guidance is given.

Table 8: Selected tools and methods to assess other emissions

Emission source	Proposed tool or method
Emissions due to increased use of fossil fuels for agricultural management	'Estimation of emissions from the use of fossil fuels in agricultural management' tool under section VI.2 of the VCS SALM Methodology (link)
Emissions from increased fertilizer use (organic and inorganic)	Latest version of the CDM A/R Tool 'Estimation of direct nitrous oxide emission from nitrogen fertilization' (link)
Estimation of increased direct nitrous oxide emission from Nitrogen-fixing species and crop residues	If the intervention area cropped with Nitrogen-fixing species is more than 50% larger than the area under Nitrogen-fixing species in the baseline, emissions from the use of Nitrogen-fixing species can be estimated using the tool 'Estimation of direct nitrous oxide emission from N-fixing species and crop residues under section VI.1 of the VCS SALM Methodology (link)

Output: An understanding of other potential emissions arising from the intervention, which can be used to ensure that the quantification method (Step 5, below) covers these or that other tools, such as those described above, are added.

Step 4: Consider leakage

Leakage is defined as increase in GHG emissions outside of the intervention area as a result of the intervention activities. Generally, the risk of leakage can be considered small.

In terms of activity shifting leakage, one possibility might be a shift of production of the goods and services under an intervention to outside of the intervention area as a result of possible productivity (yield) reductions within the interventions area. Since an intervention within a supply chain or supply shed usually aims to avoid productivity reductions, leakage need not to be accounted for as long as it can be demonstrated that the production of goods and services within the intervention area remains constant or is increasing.

Another possible source for leakage is the competing use of resources within an intervention area causing an increase of emissions. For instance, if the use of plant residues is promoted for composting under an intervention, whereas they were used for feeding livestock and/or cooking under baseline conditions, an increase of fossil fuel

emissions (or other emissions) might arise. If such emissions are significant (>5% of the total SOC change in a given year associated with the purchase of goods and services), these emissions should be estimated and deducted from the total SOC removals under an intervention. The documentation should provide evidence to demonstrate if leakage is expected to be considered zero.

Lastly, there might be leakage risk if exogenous organic inputs (e.g., compost, bio-char, etc.) to the soil from outside the intervention area are applied. This will lead to a decrease of organic material outside of the intervention area. If significant, this source of leakage must be accounted for unless it can be demonstrated that leakage can be considered zero.

Output: An understanding of other potential emissions, including leakage arising from the intervention, which can be used to ensure that the quantification method (Step 5, below) covers these or that other tools, such as those described above are added

Step 5: Choose a quantification method

Companies applying this Soil Guidance should by now have a clear definition of the intervention, a decision on whether they will apply Activity-based on Direct-measurement approaches and a rationale for what should be included/excluded from the assessment. With this information, it is possible to select a suitable quantification method.

Table 9 provides a series of questions that a company should be able to answer about their selected approach. This table can be used to benchmark the quality of a given approach, though this does not imply that all companies should apply the most rigorous approaches available.

Table 9: General criteria for selection of quantification methods

Criteria		Recommended criteria
Scope Criteria		
1:	Is the approach suitable for the context of the intervention, notably	Some methods are global/generic but most are targeted at specific activity types and geographies. Companies should not try to apply methods that do not properly account for their activity or that use approaches intended for other geographies that are different from the context of the intervention.

	geography and activity?	
2:	Does the method chosen cover the Scope identified in Step 3.1 of this Soil Guidance?	Step One, specifically 1.1, helps to define which SOC impacts should be included, based on materiality and other factors. It is important to check that the method chosen includes this scope, while excluding those that were rejected.
3:	Is the approach suitable for the reporting purpose sought?	Companies may report for many reasons, most notably for Greenhouse Gas Protocol or other reporting protocols such as GRI and CDP. The company should satisfy themselves that the method chosen conforms with any criteria stated in the reporting protocols it is intended for. Likewise, if any part of the intervention is seeking carbon credits, a methodology that is approved by the credit issuer is likely necessary.
Quality Criteria		
1:	Is the method third party authored or reviewed?	It is generally not recommended that companies create their own quantification approaches. Relying on well-chosen third party methods may avoid accusations of poor quality, conflicts of interest or green-washing. Where self-authoring of methods are unavoidable, these should be based on peer-reviewed science and reviewed and approved by a suitable third party (e.g., see Criteria 7, below)
2:	Is the method recent and based on up to date science?	It is recommended that the latest version of a chosen method is applied. Ideally the version would have been published within the two to three years prior to application though longer may be necessary in circumstances where this is unavoidable (such as where no other methods exist). It is recommended in such cases that the company highlights this transparently in reporting and explores ways to bring the method up to date.
3:	Is the approach scientifically peer reviewed?	All methods should be based on good science. Methods that are peer reviewed or include scientifically peer-reviewed approaches should be chosen over those that do not.
4:	Has the method been approved by a Standards body, such as Gold Standard?	For enhanced confidence in the method chosen, or where it is desirable to use for the purposes of certification, then the selection of a methodology that has been approved by a body such as Gold Standard may be beneficial. Depending on the answers to questions 4 and 5 above the methodology may require some adaptation.

5:	Does the company have the technical capacity and resource to apply the method?	Companies should choose an approach commensurate with their skill and capacity to implement. While more rigorous approaches are often desirable, it is better to choose an approach that can be realistically implemented than one that is unlikely to be maintained.
6:	Are all assumptions and the level of uncertainty/confidence in the results generated clear and transparent?	Per the Interventions Guidance, companies should transparently report any assumptions inherent in the method chosen and the level of uncertainty in the results generated. This helps to avoid accusations of over-reporting or over-stating results where a more practical but less rigorous approach is being applied.
7:	Are the results of the method verifiable?	Verification is recommended under the Greenhouse Gas Protocol. Third party verification gives a company greater confidence in the results and a greater defence against any external questions. The results of the method chosen should therefore be fully verified by a qualified and competent third-party auditor.

With these criteria, it is possible to select or design a method based on the decision to choose Activity-based or Direct-measurement monitoring approaches and in line with the intervention definition. As each monitoring approach entails different characteristics, two sub-steps are presented that may be followed depending on which approach was selected:

Output: Company has the information to choose a method based on their specific context. If an approach has already been chosen (for example, because this Soil Guidance is being applied to an existing intervention), the company should be able to give clear rationale supporting their choice and identify any gaps to be resolved.

Step 5a: Accounting methods for Activity-based monitoring approaches

This section provides guidance for the application of the Activity-based Approach to account for changes of SOC. It proposes existing tools and methods that can be applied for different intervention activities, and therefore does not present one specific method. This focuses on the identification of activities first in the baseline prior to an intervention and under an intervention, which then will be monitored continuously throughout the time of an intervention. These proxy indicators of activities are then used to derive SOC impact factors using different methods and tools.

The set of recommended methods are from validated carbon accounting methodologies under different standards, including Gold Standard, VCS (Verra), the UN Clean Development Mechanism (CDM), or Plan Vivo. The advantage and use of such an Activity-based survey system is that it can be designed to achieve multiple benefits.

Above all, the system is transparent for the producers who are actively involved in any intervention activities. Furthermore, it provides mutual benefits for ongoing or future intervention implementation, extension and impact monitoring. This includes identifying specific training needs and priority interventions for extension. Activity monitoring engages the producers, provides crucial information to improve extension and self-learning structures and creates an environment of committing the producers to the relevant mitigation activities.

Table 10: Potential methods and tools for different intervention activities

Intervention practices	Description	Recommend tools and methods	Elements of the methodologies and tools which are relevant for this guideline
Conservation tillage practice in combination with residues retention, mulching, etc.	Conservation tillage methods are introduced to intervention areas previously under more conservative management. This includes forms of minimum or reduced impact tillage which causes less soil disturbance than conventional forms of tillage and where residue, mulch, etc. is left on the soil surface to protect soil and conserve moisture.	Approaches 2 or 3 from the 'The Gold Standard Methodology on Increasing Soil Carbon Through Improved Tillage Practices' (link). This methodology provides a practice-based estimation (Approach 3) based on the methodology described in the IPCC 2006 Guidelines for National Green-house Gas Inventories and a framework guidance (approach 2) to use available scientific publications which also includes the use of soil	Sections 4 – 9

		carbon models (see next tool).	
Any activities which increase the organic matter inputs to the soil	Typical practices include composting, biochar amendments, residue retention (mulching), cover crops (green manuring), organic inputs from trees planted (below and aboveground inputs), manure application. Note that certain activities (e.g., manure) include leakage, while others do not (e.g., cover cropping). See Part Three, Step Four.	The use of the RothC-soil carbon model as described methodologically in the VCS SALM Methodology (link). A user friendly Excel version of the soil model is available including guidance on how to calibrate and use it with input values from the activity data (link). Another 'version' of this method is well-described in the Plan Vivo Shamba Tool Methodology (link)	VCS SALM: Section II 4. - III 1.9; IV 1.1,1.2; IV 2.3 -2.5 Plan Vivo Shamba Tool Methodology; chapter 8
Improved grazing and pasture management	This includes sustainable grassland management practices, such as improving the rotation of grazing animals between summer and winter pastures, limiting the timing and number of grazing animals on degraded pastures, and restoration of severely degraded land by replanting	The VCS Methodology 'Sustainable Grassland Management' (link) provides a similar soil carbon modeling option (Option 1 of the methodology) as the SALM Methodology. The RothC model can also be used for grassland as long as the organic inputs to soil under baseline and the intervention can be quantified. (Note that RothC does not include a direct measurement of SOC though estimates of litter	Chapter 8.1 – 8.3; 9

	with perennial grasses and ensuring appropriate management over the long-term.	fall that can be added to crop residue.)	
Planting of trees for agro-forestry products	Any activities where baseline land use systems are converted into perennial forest or agroforestry system by planting trees	If only SOC change as a result of planting trees is accounted for, the CDM 'Tool for estimation of changes in soil organic carbon stocks due to the implementation of A/R CDM project activities (link) can be used. An Excel based version of this CDM tool is available (link1; link2)	

The links provided will guide analysts to the full methodology documents which include a lot of requirements and procedures which are not required under this Scope 3 accounting. The main accounting elements of the respective tools and methodologies are indicated in Table 9.

Activity Baseline and Monitoring Survey

For this Activity-based approach, most of the methods and tools listed above recommend or require the design and implementation of a survey of land management activities both in the baseline and under an intervention as part of the monitoring. Nevertheless, also other methods are applicable to retrieve detailed information on land management practices. However, the parameters collected describing the different activities define the level of uncertainty of SOC change estimation using a specific tool. Therefore, it is recommended designing a survey in a way to estimate and manage uncertainty of the input parameters used in the tools and models above. A guidance for the uncertainty estimation is provided below.

Table 11: Useful activity survey design guidance

Survey guidance	Comment

'Guideline Sampling and surveys for CDM project activities and programs of activities' (link)	A broad overview document on generic approaches for sampling and surveys applied in most CDM as well as voluntary carbon projects
'The Gold Standard Sampling Guideline for projects applying the Gold Standard Cool Farm Methodology' (TBD)	A short and comprehensive guideline
Activity Baseline and Monitoring Survey Guideline for Sustainable Agricultural Land Management practices (SALM) (link)	Explains in detail the design and structure of a survey system with specific reference to the VCS SALM Methodology and to the Kenya Agriculture Carbon Project

Step 5b: Accounting methods for Direct-measurement based monitoring approaches

This section provides guidance to the second approach where a SOC impact factor is derived based on direct SOC measurement methods. This section also recommends a set of established and practice proven methods rather than presenting one specific method. After selecting and designing an adequate and representative soil sampling system for the intervention area - a first soil sampling is required representing the baseline conditions, typically at the start of the intervention. The same sampling is then repeated periodically (for instance every 3-5 years) as part of the monitoring. The results of these Direct-measurements at one point in time normally represent the total average SOC stocks per unit of area of intervention (e.g., tonnes carbon per ha). The difference between two measurements indicates the carbon stock change:

Equation 2:

$$\Delta C_{SOC} = C_{SOC,\,tn} - C_{SOC,\,tn-1}$$

Where

ΔC_{SOC}	Change in soil carbon stocks during the period between two points of time tn-1 and tn; tC ha^{-1}
$C_{SOC,tn}$	Carbon stock in soil organic carbon as estimated at time tn; tC ha^{-1}
$C_{SOC,tn-1}$	Carbon stock in soil organic carbon as estimated at time tn-1; tC ha^{-1}

Note1: The first Direct-measurement prior to an intervention represents the baseline (initial) soil conditions and is commonly indexed as t0

Note2: Every subsequent monitoring measurement during an intervention t1, t2, tn is compared to the measurement of the previous monitoring measurement; i.e. t1 – t0; t2-t1, etc.

Table 12 provides a list of SOC sampling and measurement protocols to set up a Direct-measurement system under this approach. However, given the huge variety of existing SOC measurement protocols and the advancing technology improvement in this field of research, an alternative protocol can also be used, provided that it follows scientific standards and that it has already been applied in practice in carbon certified projects or in scientific field studies.

Table 12: Selected SOC Direct-measurement protocols

Measurement protocol	Comment
ICRAF 'Protocol for modelling, measurement and monitoring soil carbon stocks in agricultural landscapes' (link)[10]	This protocol has been developed over a number of years through various projects and is currently being refined in the context of the Africa Soils Information Service (AfSIS: www.africasoils.net). It covers all aspects from sampling design, field measurements, laboratory analysis, and data analysis.
The VCS (Verra) VM0021 Soil Carbon Quantification Methodology provides a specific module on 'Estimation of Stocks in the Soil Carbon Pool' (link)	This module provides the methods to estimate the required number of soil plots in each strata, design and establish the plots, determine the carbon stock in the soil carbon pool, and check the statistical rigor of the results.
'GHG Assessment Guideline Volume I Soil' developed by Ethiopia under the Agriculture Guidance of the GHG Protocol (link)	This protocol provides a detailed summary of direct soil carbon (and nitrogen) measurement methods (including indirect methods) and a detailed procedure for the field application.

Output: A method for accounting and reporting emissions, based on the characteristics of the intervention and the needs of the reporting company, can be selected and the choice justified and defended.

10 Aynekulu E, Shepherd, KD, Coe R, Walsh M, Vagen T, Winowiecki L, Chen K, Sila A. 2015. A protocol for measurement and monitoring soil carbon stocks in tropical landscapes. Version 1.1. World Agroforestry Centre, Nairobi, Kenya

Step 6: Be transparent about uncertainty and assumptions

Following the good practice set out in the Interventions Guidance, proponents of an intervention should transparently disclose any assumptions and the level of uncertainty involved in their baseline and intervention impact calculations and reporting. Therefore it is good practice to estimate the uncertainty of the SOC impact factors derived from different activities under an intervention.

The uncertainty of SOC impact factors derived from Activity-based estimation using models and default methods can be estimated following the uncertainty chapter of the Gold Standard Methodology on 'Increasing Soil Carbon Through Improved Tillage Practices' (link). This section provides a clear procedure to assess uncertainty of input parameter. In addition, most of the tools proposed also include specific guidance on uncertainty estimation and management. For Direct-measurement, the uncertainty of the SOC sampling should be calculated and reported based on the guidance provided in the measurement protocols.

As stated in the Interventions Guidance, GHG emission estimates are a product of the emission factors of a given product or service and the quantity or volume of goods and services produced during a given year. To derive the emission factors many equations and conversion factors and other parameters are available, for example, from existing accounting tools, standard methodologies or the IPCC Guidelines.

The use of higher-tier emission factors may increase reliability, reducing uncertainty in the estimation of GHG emissions. However, a balance should be struck between accuracy or precision and the costs of GHG quantification, based on the aims and objectives of the reporting company (as stated in the Scope 3 Standard).

Quality control

Tier 2 emission factors should be used where they are available, derived from reliable research, and can reasonably be justified as representing the conditions and management practices in the project. Tier 1 default values (e.g., as provided by IPCC) should only be used if no other sources are applicable and if there a significant reason to do so.

Tier 2 emission factors can generally be obtained from peer reviewed scientific literature or references in related studies in the region of an intervention. Intervention analysts should assess the quality of available data to ensure that data derives from relevant, representative and reliable sources (see Table 13). The table is an extension of the Scope 3 Standard Accounting Principles, as set out in the Interventions Guidance.

Table 13: Data quality indicators for SOC Interventions

Source: Adapted from WRI (2014) Policy and Action Standard

Accounting Principle	Indicator	Description
Relevance	Geographical representativeness	The degree to which the data are statistically representative of land uses and management practices across the area of an intervention
	Temporal representativeness	The degree to which the data reflect the relevant time period (e.g., likely to be representative throughout intervention period or even beyond the intervention)
	Technological representativeness	The degree to which the data reflects the adoption of technologies and management practices of an intervention
Completeness	-	The degree to which the data are statistically representative of the relevant land uses and management practices of both points in time before and after an intervention
Consistency	Reliability	The degree to which data sources and data collection methods are dependable. Data used should represent the most likely value of the parameter in the relevant time period.
Accuracy	Conservativeness	A conservative estimate of baseline (prior to an intervention) is one that does not tend to overestimate GHG emissions and does not tend to underestimate carbon sinks. A conservative estimate of the impact of an intervention is one that does not tend to overestimate GHG removals (carbon sequestration) and does not tend to underestimate GHG emissions.

In general, data from sources where the survey methodology is documented, transparent, unbiased and reliable estimates of population parameters are recommended. Survey results reported in other sources may also be used where the source is documented. Where sources or methods used to produce data reported in the intervention documentation are not indicated, it is recommended to cross-check data

with other sources, and/or to consult with experts to derive a conservative estimate based on expert judgment.

Overall, the level of detail expected of methodological documentation should be sufficient to enable a third-party (external reviewers) to clearly understand how the resulting SOC impacts under an intervention were derived and to be able to judge the extent to which the resulting estimates are relevant, complete, consistent, reliable and conservative.

Output: Company can clearly state underlying assumptions and levels of uncertainty for their method and are able to articulate the rationale for why this is appropriate based on the intervention and the reporting need.

Part Three Summary: Selecting an accounting method

At the end of Part Three, a reporting company should be able to select and justify their method for accounting SOC, based on the definition of that intervention (Part One), the monitoring approach selected (Part Two) and the scope of the assessment (Part Three). This Soil Guidance provides various examples of methods that can be used under either principle approach. Companies are encouraged to conduct research, based on their answers to Table 1 to select their preferred method of quantification.

PART FOUR: REPORTING SOC CHANGE

Under this Scope 3 Standard, the overall SOC removals in a given year associated with the purchase of goods and services are calculated based on Equation 1, stated earlier in the document, and repeated here:

Equation 1:

$$\Delta SOC_y = \text{Quantity of Goods Purchased} * EF_{SOC}$$

Where:

- ΔSOC_y = SOC change in a given year associated with the production of purchased goods and services (tCO_2e)
- EF_{SOC} = SOC Emissions Factor (tCO_2e per unit, volume or mass of product)

This section explains how to take the monitoring approach and accounting method selected and apply the results generated to derive SOC change (ΔSOC). Since most of the tools and methods presented in these guidelines result in area-based SOC impact factors IF-SOC (SOC change in tCO_2e per ha) under an intervention, these impacts need to be related to the quantity of goods purchased from the intervention area.

Step 1: Apply Equation 3

Equation 3:

$$IFSOC_{I,a,y} = \sum_{A} \left(\Delta SOC_{IA,a,y} \times \frac{44}{12} \right) - IE_{a,y} - LK_{a,y}$$

Where,

$IFSOC_{I,a,y}$	SOC impact factor for intervention I in stratum a in year y; $tCO_2e\ ha^{-1}$
$\Delta SOC_{IA,a,y}$	SOC change for a specific activity A(1…n) under intervention I in stratum a and year y; $tC\ ha^{-1}$
$IE_{a,y}$	Significant intervention emissions in stratum a and year y; $tCO_2e\ ha^{-1}$
$LK_{a,y}$	Significant leakage emissions in stratum a and year y; $tCO_2e\ ha^{-1}$

Step 2: Apply Equation 4

For this step the production of goods and services produced per stratum under an intervention is required in the unit most commonly used for a particular good.

Equation 4:

$$EF_{SOC,y} = \sum_{a} \left(\frac{IFSOC_{I,a,y} / P_{a,y} \times A_a}{A_I} \right)$$

Where,

$EF_{SOC,y}$	SOC Emissions Factor in year y (tCO_2e / quantity of product)
$IFSOC_{I,a,y}$	SOC impact factor for intervention I in stratum a in year y ($tCO_2e\ ha^{-1}$)
P_a	Quantity (volume or mass) of goods and services produced per hectare under an intervention in stratum a and year y (e.g. t or litres ha^{-1})
A_a	Area of stratum a (ha)
A_I	Total area of intervention = sum of all strata (ha)

Step 3:

Overall impact on SOC (ΔSOC_y) for a specific quantity of products purchased is calculated according to Equation 1 of this guideline (in tCO_2e).

Step 4: Report & Communicate

The above steps provide a guidance on how to define the Emissions Factor 'variable' associated with SOC for purchased goods and services. To apply the above figures to Greenhouse Gas Protocol reporting, companies should refer to the Interventions Guidance and the Scope 3 Standard. The Scope 3 Standard states that biogenic sequestration should be reported separately to Scope 3 emissions and hence it is not necessary to incorporate the SOC results into the overall Emissions Factor for purchased goods and services.

Part Four Summary: Deriving SOC

By taking the results of the intervention, as produced by the selected accounting method and applying them to the equations of this section, SOC can be derived and reported. The reporting company has the rationale for how this figure was arrived at, based on the application of Parts One to Four. This should include the uncertainty and assumptions associated with the figure reported.

The figures resulting from the intervention can be used to report results, noting that under the Scope 3 Standard biogenic sequestration is to be reported separately to emissions.