# Regenerative Standard v1.0 09292022

## Open Source

## Rangeland, Grassland, Agricultural and Conservation Lands Soil Carbon Quantification Method

## Protocol for Applying the Technical Procedures of Verra's VM0021 to Soil Carbon Regenerative Projects

# 1.0 Rationale for the Standard

There are many standards describing how carbon credits from nature-based soil carbon storage are being generated. However, there are few standards that combine a strong emphasis on credit quality while also making it easier for landowners to participate in nature-based carbon storage opportunities. To enable the implementation of nature-based carbon solutions at a scale that matters, it is essential to combine high-quality credits generation with easy accessibility for landowners to participate.

The Regenerative Standard is designed to:

1) describe how carbon drawdown credits can be generated through nature-based atmospheric carbon drawdown and reliable soil carbon storage,
2) to guarantee delivery of high-quality carbon drawdown credits, based on rigorous soil sampling, laboratory analysis and independent 3rd party verification
3) and, to make it much easier for land stewards to initiate and participate in carbon storage project opportunities, by removing typical participation barriers.

To meet these objectives, the Regenerative Standard combines best practices, rigor and innovative approaches from several existing standards.

The standard is primarily based on Verra VM0021, with the addition of several modules to handle additionality and permanence requirements in a more innovative, pragmatic and land-steward friendly manner, in line with innovation described in the novel BCarbon standard.

The Regenerative Standard is documented in a way that Verra VM0021 is considered the main foundation of the standard, and only exceptions and/or modifications to Verra VM0021 are documented and described in detail.

The Regenerative Standard applies only to carbon drawdown credits and will not include any benefits from "avoided emissions" credits.

# 1.1 Objectives of the Regenerative Standard

The Regenerative Standard is intended to be:

a) **Easily understood:**
Farmers, ranchers and conservationists, from now on called “land stewards”, the conservation community and carbon credit buyers must be able to rapidly understand the standard and the high-quality carbon drawdown credits are being generated.

b) **Measurement and performance based:**
This standard is strongly based on rigorous, up to 1 m deep, soil sampling, analysis, and the generation of high-quality data. Atmospheric carbon storage is determined on the basis of measured soil carbon increase, not on the basis of models and assumptions. Ultimately soil carbon quantification for every project is the up to 1 meter deep measured increase of soil carbon storage and corresponding removal of greenhouse gas (GHG) through photosynthesis and excludes credits on the basis of emission avoidance. The robust data provides land stewards defined measures and methods to monitor the progress on their land towards improved soil health and soil carbon.

c) **Based on defensible science foundations:**
This standard is focused on generating real, meaningful on-the-ground soil carbon data, based on rigorous up to 1 m deep soil sampling, and integrating proven technologies to improve confidence levels and reduce uncertainty through quantitative statistical analysis. Initial soil sampling (T0), and subsequent resampling (T1), determines the soil carbon increase. A trusted measurement-based standard is critical to ensure that carbon credits are fully based upon actual soil organic carbon storage increase in the project area.

d) **Based on best practices and common sense to replenish, restore, regenerate and recover one of our most vital resources on earth: our soil:**
The standard will incentivize land stewards, through its measurement-based soil carbon credits, to manage for ecological health and soil health, which will enable higher soil carbon storage. If the soil system of a farm, ranch or conservation area is depleted, then the land steward’s efforts to improve and restore that land bestows benefits to the wider community and ecosystem. This standard is designed to facilitate implementation of robust science measurements and the adoption of soil regenerative practices that ensure the restoration of the earth’s soil carbon storage battery occurs in agricultural, ranch and conservation lands.

e) **Trusted:**
This standard and the rigorous data-driven approach is completely transparent and designed to make it easy to trust the carbon credits and the way they are measured, independently verified and certified.

f) **Clear decision pathway:**
This standard is focused to bring together carbon project stakeholders: investors, scientists, land stewards and carbon credit buyers, around greater certainty on the carbon impact, the investment, measurements, farm/ranch revenue generation timelines and returns on investment potentials. This is the transparent

data-driven framework to drive investment over time by any applicant and to refine and improve data quality, through measurement and predictions.

g) **Cash flow positive:**
Land stewards and the business community all have at least one thing in common, the need for fast access to results, value, and cash flow positive operations. An accelerated access to generate carbon credits and the resulting carbon credit payments to land stewards is an important enabler to support land steward participation at scale. The Standard enables the issuance of independent third-party verified, interim credits in the soil sampling period between T0 and T1. This enables annual generation of cash, through the forward assessment of interim credits. These carbon payments, available to land stewards, enables them to invest in regenerative practices and infrastructure support to improve soil health and reduces the stress on all counterparties involved in the land management activities, measurement and reporting, and verification and validation of the benefits. Although interim credits are important to lower project participation barriers, it is essential that ultimately all final credits awarded are based on the difference between a quantitative baseline soil measurement (T0) and the second soil measurement made 4 to 7 years later (T1).

h) **A Practical learning journey to make soil carbon projects work at scale:**
High quality soil measurement, independent project verification, and a commitment to open-source learning assures this standard continues to improve the reliability of project success while adapting to new proven management practices and technology that can accelerate results. This standard is developed to rapidly create a system that can work at increasing scale.

i) **Living document, which is adaptively refined throughout the learning journey:**
Practical and justified improvements to the standard, included methods, and verification guidance documentation are anticipated. The authors and stewards of this standard welcome suggestions on adaptive refinements which can be directed to Applied Ecological Institute. Responses will be provided in 10 business days of receipt of any suggestion.

# 1.2 Introduction to the Standard

This standard is based on the technical procedures of Verra Methodology VM0021, in which the farmers, ranchers, or conservationists ( “land stewards”) are focused on land conservation, restoration and regeneration. In addition, new sections are added to the standard to address additionality and permanence requirements in a more innovative, pragmatic and land-steward friendly manner. The Regenerative Standard is documented in a way that Verra VM0021 is considered the main foundation of the standard, and only exceptions and/or modifications to Verra VM0021 are documented and described in detail in this standard. The Regenerative Standard applies only to carbon drawdown credits and will not include any benefits from “avoided emissions” credits.

This standard is strongly based on rigorous, up to 1 m deep, soil sampling, analysis, and the generation of high-quality data. Atmospheric carbon storage is determined on the basis of measured soil carbon increase, between T0 (at the start of the project) and T1 (4-7 years later), and not on the basis of models and assumptions. However, the Standard enables the issuance of independent third-party party verified, interim

credits in the soil sampling period between T0 and T1. This enables the generation of annual cash flow for land stewards and project execution, which is relevant to deploy nature-based soil carbon projects at scale.

The primary variation from Verra VM0021 are Permanence and Additionality which are briefly summarized below but all VM0021 deviations are clearly identified in Chapter 2 of this standard:

Permanence Term:

The Regenerative Standard Permanence term is designed for pragmatism. It works for land stewards, and it will give carbon credit buyers the long-term guarantees they need. The standard allows a more pragmatic, but shorter carbon storage permanence term of minimal 10-years after each issuance of carbon credits. If a land steward generates certified carbon credits the minimal 10-year forward rolling permanence provides project permanence assurance. Most land stewards will enroll in carbon projects with contractual participation of at least 5-years, leading to a project permanence of 15 years (5+10). In practice, actual permanence will be much longer. Regenerative land management will become more profitable over time and provide a natural incentive to manage healthy soils for many decades. If soil is not disturbed, then soil carbon is resilient for thousands of years.

Additionality:

Many existing standards work with additionality requirements that exclude or make it difficult for land stewards to participate in carbon projects. Although the rationale of the traditional additionality approach is understandable, its unintended consequence is that many promising nature-based solutions are faced with unreasonably high entry barriers. The Regenerative Standard allows 2 ways to guarantee additionality: 1) traditional additionality as defined under Verra VM0021, or 2) an absolute measured additionality. The latter is designed for pragmatism, low entry barriers and data-driven high-quality credits (adapted from the new and innovative Bcarbon standard). **Atmospheric carbon drawdown and storage is considered additional if 2 conditions are met:**

1) an absolute increase in soil carbon can be measured, using a static baseline. This means the absolute carbon storage in a certain time-period (T0 to T1) is based on the difference in soil carbon content at T1 minus the soil carbon content at T0.

2) Land stewards make continuous land management decisions and implement continuous enhancements of regenerative land management practices. Project proponents can demonstrate (often via a contractual agreement) that continuous implementation of additional regenerative practices is occurring.

**Chapter 2** addresses the crediting framework and treatment of core concepts including boundary, additionality, permanence, and leakage.

2.1 Eligibility and Variation from VM0021

2.2 Baseline Scenario

2.3 Additionality

2.4 Leakage

2.5 Permanence

2.6 Credit Release

2.7 Annual Checklist and Proof of Activity

2.8 Independent Validation and Verification

**Chapter 3** describes the potential development of six different methods that can be used to make a conservative forward-looking assessment of both the carbon stocks and carbon stock changes over time (e.g., the rate of carbon accrual) on grazing, agricultural or conservation lands under this standard. Regardless of what forward-looking carbon storage estimation method is initially used, direct sampling is performed consistent with up to 1 meter deep soil sampling to establish the baseline of soil organic carbon on site. T1 is performed to obtain up to 1 meter deep soil sampling within ~4 to 7 years to true-up for the project in which the baseline soil sampling from the project is compared to the second soil sampling event. **For Regenerative Standard v1.0, only Method 4 is currently available.**

3.0.1 Project Documentation

3.1.1 Method 1: Interim Crediting Based on Literature SOC Accrual Rates and Site Vegetation Measurement - **Suspended**

3.1.2 Method 1: Worked Example- **Suspended**

3.2.1 Method 2: Interim Crediting Based on Literature SOC Accrual Rates and Shallow Sampling - **Suspended**

3.2.2 Method 2: Worked Example - **Suspended**

3.3.1 Method 3: Interim Crediting Based on Literature SOC Accrual Rates and Predictive Model - **Suspended**

3.3.2 Method 3: Worked Example- **Suspended**

3.4.1 Method 4: Interim Crediting Based on Site Stratification and Soil Sampling up to 1 meter Depth

3.4.2 Method 4: Worked Example **- Under Development**

3.5.1 Method 5: Interim Crediting Based on Site Stratification and Soil Sampling up to 1 meter Depth and Chronoseries data- **Suspended**

3.5.2 Method 5: Worked Example- **Suspended**

3.6.1 Method 6: Interim Crediting Based on Site Stratification and Soil Sampling up to 1 meter Depth and Chronoseries data, and Chronoseries Data with a Site-Specific Calibrated Model validated with FLUX tower or other comparable technology- **Suspended**

3.6.2 Method 6: Worked Example- **Suspended**

**Chapter 4** provides the standard procedures and process for verification of projects submitted under this standard.

# 1.3 References Supporting Regenerative Standard

1. VM0021 Soil Carbon Quantification Methodology, v1.0
2. VM0026 Methodology for Sustainable Grassland Management (SGM), v1.1 (degraded lands)
3. VM0042 Methodology for Improved Agricultural Land Management, v1.0 (Indigo Ag)
4. VMD0018 Methods to Determine Stratification, v1.0
5. VMD0019 Methods to Project Future Conditions, v1.0
6. VMD0020 Methods to Determine the Project Boundary
7. VMD0021 Estimation of Stocks in the Soil Carbon Pool, v1.0
8. VMD034 Methods for Developing a Monitoring Plan
9. ISO 14064 - 2 Specification with guidance at the project level for quantification , monitoring and reporting of greenhouse gas emission reductions or removal enhancements
10. ISO 14064 - 3 Specification with guidance for the verification and validation of greenhouse gas statements
11. VCS Validation and Verification Manual v3.2

# 1.4 Glossary

**Buffer**: A percentage of project carbon credits reserved by the Credit Registry to ensure that Interim Carbon Credits in the forward assessment are not over-stated and that a project shortfall can be addressed with the buffer. In addition, the buffer is retained for the 10 year carbon storage commitment to ensure that Land Stewards retain the increased Carbon storage for the 10 year storage commitment. Typically the Buffer is set at 10% unless a Project Proponent can provide a statistical analysis that demonstrates that the project (or portfolio of projects) are at a lower risk of shortfall of carbon credits at the end of the initial project and are at reduced risk for negative impacts to declining carbon stocks during the storage period. The Registry will determine a mechanism to release the buffer (or a portion of it) following the storage period.

**Project Start Date**: field sampling date of T0 for any Project.

**Standard**: The Regenerative Standard which includes 6 Methods to implement a Carbon Project. The Methods within this standard are defined based on the extent of scientific information available for the Project.

**Validation** - validation of the standard (validation is revisited if material changes occur to the Standard).

**Verification** - verification of the project application by an independent verifier prior to submission to the Land Conservation, Restoration and Regeneration Registry which is operated independently from the Project Proponent and Verifier.

# 2.0 Crediting Framework

Projects developed using this standard shall adhere to the following mandatory criteria related to performance-based results.

a. **Final Crediting:** Final crediting shall be based on statistically valid and robust soil carbon improvements based on real soil measurements, and not exclusively on activity changes. This standard is focused on measured draw down soil carbon credits and not on emission avoidance. This variation from VM0021 permits the production of a higher quality soil carbon credit that is independent of emission avoidance credits.

b. **Interim Estimations:** Soil carbon improvements (or stock changes) are made associated with defined activity changes and credit issuance will be based on the estimation strategy chosen by the proponent associated with such activity change. The project proponent shall ensure that SOC stocks are measured within the confidence and uncertainty factors required under VM0021.

c. **Credit Release**: Under no circumstances will estimations based on anything less than the robust landscape biophysical stratification process (VMD0018), and robust statistical sampling requirements following VM0021 be used for determining final credit releases (true up) for the project.

d. **Soil Sampling**: Must be designed and executed in accordance with the technical procedures under Verra's Soil Carbon Quantification Methodology VMD0021 and VMD0018 Methods to Determine Stratification. Additional data from developing technologies, published data or unpublished data from reputable agencies or non-governmental organizations may be included to complement the up to 1 meter deep soil sampling to ensure increased confidence and reduced uncertainty for the project.

e. **Required Project Documentation:** Project design, documentation, execution, QA/QC, computational requirements, carbon accounting roll up and representation requirements shall follow VM0021 unless otherwise specified in this document.

f. **Deviation Justification:** Any deviations and modifications to the technical procedures in VM0021 shall be documented in this standard, and it is recommended that they also be described in the project design document.

g. **Greenhouse Gas (GHG) Emissions:** - GHG emissions associated with external inputs (e.g., lime, supplemental feed, fertilizer, etc.) are accounted for, such that increases in these emissions due to

project activities can be deducted from the overall credits issued, if appropriate. If GHG from external inputs are the same both before and after the activity change, then the project's GHG performance will be based exclusively on soil carbon stock changes.

h. **ESG (Environmental, Societal and Governance) Documentation:** The project should document the social, economic and biodiversity changes under the proposed project activity, in order to meet growing accountability demands for transparency from governmental, corporate, and individual stakeholders. The proponent may choose at their discretion, depending on the representations they intend to make, to use standards and process for creating this application documentation:

Examples of ESG measures include:

1. **Biodiversity:** Species count, genetic diversity or other specific, applicable biodiversity measures following measurement and documentation requirements that can be assessed and measured.

2. **Water quality:** Outcomes related to both surface (rivers/dams etc) and underground (e.g. reduced nutrient loads due to overfertilization, reduced pesticide loads, etc) that can be assessed and measured.

3. **Societal/cultural:** Outcomes that can be assessed and measured (e.g. development of sustainable land management practice education in local community college or other advanced learning setting.)

4. **Governance:** Outcomes that can be assessed and measured (e.g. development of long term value creation for community conservation and environmental commitments.

i. **Archived Soil Samples and Data:** VMD0021 will be followed to determine the number of archived soil samples retained until verification and project completion. Archived samples of all soil samples submitted should be kept at least until completion of next verification. Additionally, a **sufficient number of samples from each sampling event** to cover the range of conditions expected to be found in the project area under the project scenario should be stored for the life of the project to allow recalibration of results where future advances in soil testing methods may result in potential loss of comparability between results. Soil carbon data collected for the project should be archived in a standardized format to enable submittal into a data depository. The anonymized datasets will require accurate georeferencing of all submitted data and should be made available to the carbon standard organization to enable further development of national carbon stock accrual statistics related to each activity change.

# 2.1 Eligibility and Variation from VM0021

This standard is intended for use by projects on agricultural, grazing, and other regenerative, restorative or conservation lands. Planned and/or implemented land management practices must be incorporated in the

project plan to ensure that the project will increase the actual measured storage of soil organic carbon within the boundaries of the project.

The **project boundary** is identified by the project proponent. Projects that have or are implementing regenerative or restoration projects on rangeland, grassland, agricultural and conservation lands can be considered under this standard. Soil carbon storage increases are estimated in a forward assessment based upon the land management practices and the topography, soil, climate and vegetation of the site. Final carbon storage is measured with up to 1 meter deep soil sampling at the beginning and end of the project credit term period (typically 4 to 7 years) with 10 year storage commitment for each year of credit term. Suitable documentation is provided to ensure ownership or control of the land defined for the project and anticipated activities are defined. Spatial variation of project area is addressed for soil, vegetation, and land management. Projects under this standard vary from VM0021 in that the final carbon crediting is limited to soil organic carbon measured changes between T0 (initial) and T1 (subsequent) utilizing up to 1 meter deep sampling measurement campaigns. Emission avoidance credits are not considered in the standard. This variation from VM0021 ensures the highest quality carbon credits available to carbon credit buyers and ensures the highest ecological impact to lands managed under this standard.

The **project crediting period** is at least 5 years with a ten year storage requirement for each credit year and can be renewed an unlimited number of times. This project period varies from VM0021 largely to ensure that more land can be managed under the standard due to the resistance from farmers and ranchers to commit to 30 to 100 year contracts. Essentially a 15 year total commitment of a 5 year credit term coupled with a 10 year storage requirement for each year of credit term, permits a landowner to engage in a regenerative contract to improve the land, but does not create an onerous, long term commitment on the next generation land owner for the property. The early pilots of this standard and other standards with shorter crediting period (i.e. BCarbon) have shown that more landowners are interested in engaging in ecological valuable projects with shorter commitments. However, many landowners, after receiving initial interim credit payments, indicate interest in additional crediting periods. Thus, a shorter crediting period allows broader adoption of the standard than would otherwise occur with a 30 to 100 year crediting period.

The **project start date** is defined as the date of commencement of the time zero (T0) set of soil measurements. This measured project start date begins the project clock. The project start date can be up to 5 years prior to the project registration date if Time Zero (baseline sampling or T0) sampling consistent with Method 4 is available for use in this standard. This VM0021 variation of project start date and limited crediting of previously implemented activity is specifically focused on the early adopters of regenerative and restorative practices that either independently, or as part of larger research projects, implemented up to 1 meter deep soil sampling and consistently executed the management practices resulting in increased soil organic carbon on the project property.

**Project registration** is required of the proponent by application submittal to the Regenerative Registry for any project proposed under this standard. Formal project registration must follow the requirements of the registry consistent with VM0021.

Additional items in the standard that vary from VM0021 are described in detail in Sections 2.2 Baseline, 2.3 Additionality, 2.4 Leakage, and 2.5 Permanence.

Eligibility for every Method requires project proponent to document suitable literature or other data for forward assessments and to demonstrate the scientific basis for inclusion of the specific data and the reasons for exclusion of specific data. Site specific conditions of topography, climate, soil type, and vegetation shall be used to support the relevance of the references/data used for the project forward assessment. Other relevant considerations relating to uncertainty in carbon stock estimations for the Project arising from the literature (e.g. due to differences in geographic/spatial resolution of the studies, methodology, sampling strategies of the studies, etc) should be both referenced by the proponent, and used to determine the relevance of the data for SOC estimations of the project. In addition to a project proponent's representation of the relevance of the literature to the specific project, the proponent will ensure any references are credible. Credibility may be surmised from either the publishing or peer review of the information or utilization of data sets from scientific agencies or groups (e.g. NASA, USDA, USGS). Published or unpublished data sets where the proponent can demonstrate both credibility and relevance to the specific project may also be incorporated. Applications for crediting will follow VMD0019 Methods to Project Future Conditions.

The project proponent describes the project and its context in a **GHG project plan** that includes the following:
a) project title, purpose(s) and objective(s);
b) type of GHG project, including descriptions of how the project will achieve GHG emission reductions and/or removal enhancements and specific GHGs targeted;
c) project location, including organizational, geographic and physical location information, allowing for the unique identification and delineation of the specific extent of the project;
d) conditions prior to project initiation;
e) project technologies, products, land management practices, services and the expected level of activity;
f) aggregated GHG emission reductions and removal enhancements, stated in a unit of measure required by the intended user for reporting, e.g. tonnes of CO2e, likely to occur from the GHG project;
g) identification of risks that could substantially affect the project's GHG emission reductions or removal enhancements and, if applicable, any measures to manage those risks;
h) roles and responsibilities, including contact information of the project proponent and other project participants, including the intended users, and roles and contact information for relevant regulator(s) or administrators of the GHG programme to which the GHG project subscribes;
i) a summary environmental impact assessment when such an assessment related to the project or GHG programme is required by applicable legislation or regulation;
j) relevant outcomes from interested party consultations and mechanisms for ongoing communication, if applicable;
k) a chronological plan or actual dates and justification for the following:

1) the date of initiating project activities;
2) GHG baseline time period;
3) date of termination of the project;
4) monitoring plan.

# 2.2 Baseline Scenario

The **baseline scenario**, the expected soil carbon within the project area resulting from business-as-usual management practices shall for the purposes of this standard be assumed to constant during the project period. Credit yield shall be calculated as the project scenario, or the soil carbon of the land within the project area after conversion to regenerative practices (up to 5 years prior to the project start date), minus the soil carbon of the baseline scenario.

The standard utilizes the requirement of 1-meter deep soil sampling (or to refusal) to establish a project T0 baseline, which is a variation from VM0021 definition of baseline. Using this actual measurement and assuming a **static baseline scenario** is more conservative since only (atmospheric $CO_2$) removals, rather than both removals and emission reductions, are quantified for additionality and crediting in this standard. Emission reductions might realistically occur, but due to the challenges and uncertainties of characterizing dynamically decreasing baselines, a much more conservative approach is to avoid these uncertainties by simply assuming a static baseline, or no change in soil carbon during the project period. This scenario precludes accounting for emission reductions and only allows for accounting of actual (atmospheric $CO_2$) removals, since no accounting of decreasing baselines are made, and credits are based solely on measurable increases in soil carbon levels above initial levels measured at the project start date (as assessed according to the methods described in the technical procedures in VM0021, Section 6). While a truly static baseline is possible, it is a particularly safe assumption when the baseline is otherwise likely to be decreasing in the absence of the project activity (as per VM0021 4.2 Optional Condition – Option a), as for projects involving adaptive livestock management or regenerative/restorative land management practices, for which alternative non-adaptive management practices or traditional row crop practices are likely to result in soil carbon losses due to soil degradation stemming from the deleterious consequences of forage consumption exceeding forage production (Sanderson et al. 2020) or from the lack of cover cropping/over production of cash crops. Although the more conservative approach, a stable baseline must still be evidenced through demonstration of minimal water and wind-borne soil erosion (e.g. UNFCCC/CCNUCC - Tool for the identification of degraded or degrading lands for consideration in implementing CDM A/R project activities). Such evidence could be provided by measured percent bare soil, perennial vegetation plant cover and/or invasive and non-native plant species percent cover using on-ground sampling and/or multi-temporal aerial photography or remote sensing which demonstrate the establishment of persistent vegetation cover for consecutive years, particularly following management conversion in degraded lands where re-establishment of healthy, diverse and productive plant communities can take many years. Since ultimately the baseline is established with a site visit evaluating strata, vegetation and sampling up to 1 meter deep, the results of the sampling event and other data collected during T0 represents the “best estimate” of the actual site baseline.

The **project scenario** is defined as the soil organic carbon stocks present at the next scheduled soil measurement date, calculated according to the technical procedures and methods described in VM0021. For a project that plans to conduct soil measurements every 5 years, the initial (T0) measurements for example, are taken in year zero and the project scenario measurements are taken in years 5 (T1), 10 (T2), 15 (T3), and so on.

# 2.3 Additionality

Any project must demonstrate additionality by passing one of the following tests. Option 2 varies from VM0021, Section 7 and the Option is more applicable to the land use of agriculture and grazing transitioning to regenerative and restorative practices. Reference ISO 14064-2:A.3.3 GHG emission reductions/removal enhancements caused by a GHG project may also be described as being additional if these are greater in quantity than the volume of GHG emission reductions/removal enhancements that would have occurred in the absence of the project.

**Option 1: Traditional additionality.** The project is deemed additional if it passes the standard 4-step additionality test as described in VT0001.

**Option 2: On the ground measured additionality.** The project is deemed additional if it demonstrates increased soil carbon stocks based on at least two sets of measurements taken in accordance with this standard and subject to quantitative verification. The carbon added to the soil carbon pool is additional in the sense that it has been added subsequent to the project start date and the first set of soil measurements, or five years prior, under the same regenerative management activity. If, for whatever reason, the baseline is found to change such that there is no measurable increase in soil carbon, then there is no additionality and no issuable credits.

**Atmospheric carbon drawdown and storage is considered additional if 2 conditions are met:**

1) an absolute increase in soil carbon can be measured, using a static baseline. This means the absolute carbon storage in a certain time-period (T0 to T1) is based on the difference in soil carbon content at T1 minus the soil carbon content at T0. No change or a decrease in SOC between T0 and T1 will result in no issuable credits.

2) Land stewards make continuous land management decisions and implement continuous enhancements of regenerative land management practices. Project proponents can demonstrate (often via a contractual agreement) that continuous implementation of additional regenerative practices is occurring.

Measurement of soil carbon supports land steward learning and adoption of practices resulting in additionality of soil carbon. These practices are generally based on the results achieved. Examples of best practice are included to further describe the best practice for regeneration and restoration in Addendum 1 of this standard.

# 2.4 Leakage and GHG Emissions

This standard is primarily concerned with enabling credits to be generated associated with increases in soil carbon stocks, provided those stocks are rigorously quantified using the procedures described in VMD0021. In contrast to VM0021, under this standard no credit is awarded for reductions in GHGs associated with reduced agricultural inputs such as fertilizers and pesticides, reduced usage of powered farm equipment, or reduced emissions from livestock or manure operations. This makes this standard inherently conservative in terms of the number of credits issued.

Nevertheless, the standard must offer a reasonable and sufficient assurance that the net storage of atmospheric carbon in the soil carbon pool has not been negatively impacted by increases in GHG emissions within the project area or elsewhere outside the project area.

Changes in carbon pools and GHG emissions related to both project activities and leakage for the project scenario shall be addressed with a two-step process. The first step is a qualitative evaluation to determine if the project proponent can establish with reasonable and sufficient assurance that the carbon pools and GHG emissions are likely to remain unchanged (i.e. they are not expected to change by 10% on a time weighted basis) or the potential changes are transient in nature. In the second step, if the changes in carbon pools and GHG emissions are not likely to be significant (i.e. less than 10% change expected) and can for all practical purposes be considered *de minimis* and they do not need to be quantified, and their value may be accounted as zero for the purposes of carbon crediting. Otherwise, the magnitude of the changes in carbon pools and GHG emissions must be quantified following validated protocols described in VM0021, in particular VM0035 for GHG emissions and VM0032 and VM0033 for leakages, respectively, with zero reductions to carbon crediting if any change is determined *de minimis* based on application of the CDM A/R methodological *Tool for testing significance of GHG emissions in A/R CDM project activities*.

For example, if GHG emissions in the project scenario are not likely to change by more than 10% (e.g. if average herd size over the time period of interest increases by less than 10% on a time weighted average basis), then the number of credits issued is equal to the net change in soil carbon stocks, with no corrections needed. If, however, GHG emissions under the project scenario are more than 10% greater than GHG emissions in the baseline scenario, then corrections shall be made to the total number of credits issued following the procedures described in VMD0035, which will have the effect of lowering the number of credits issued. Considering this standard does not contemplate the issuance of credits for avoided emissions associated with GHG emissions, the consideration of a 10% time weighted average change in sources of potential increased emissions is reasonable to establish an activity baseline for the determination of de minimus.

For reasonable and sufficient assurance that carbon pools and GHG emissions are not changing for the project scenario, the project proponent is required to determine, at a minimum, the likelihood of the project activities leading to an increase in GHG emissions either within the project area or outside the project area based on consideration of the most important GHG emissions related to operations in agricultural, grazing and conservation lands:

| Source | Likely to increase | Likely to stay the same | Likely to decrease | Don't know |
|---|---|---|---|---|
| Amount of animals/livestock | | | | |
| Enteric fermentation | | | | |
| Manure deposition | | | | |
| Use of fertilizer | | | | |
| Use of pesticides | | | | |
| Use of hydrocarbon fuel for gas and electricity | | | | |
| Use of hydrocarbon fuel for irrigation | | | | |
| Export of hay | | | | |
| Woody biomass (above & belowground) | | | | |
| Non-woody biomass (above & belowground) | | | | |
| Import of animal feed | | | | |
| Export of animals and animal products | | | | |
| Burning of biomass | | | | |
| Use of nitrogen fixing species | | | | |

Note that the baseline scenario changes in carbon pools and GHG emissions do not need to be quantified per this standard, consistent with the conservative assumption of a constant baseline that is not changing during the project period (following VM0021 Applicability Conditions – 4.2 Optional Condition a) and crediting of only atmospheric carbon removal based on measured changes in soil carbon as opposed to emission reductions.

In practice, typical regenerative and restoration projects do not include a displacement of grazing, fodder or agricultural production since these activities are essentially required for optimized regenerative projects. In addition, displacement of wood harvest is also not typical in these projects due to the fact that projects are generally focused on grasslands and grazing lands. For example, in compliance with VM0021, the following actions would be completed if a decline in agricultural production or significant wood harvesting is likely to occur: Tasks 3.16 and 4.15 need to be completed only if agricultural production is likely to decline as a result of the project, Tasks 3.17 and 4.16 need to be completed only if significant wood harvesting from the project area is likely to occur, Task 3.18 does not need to be completed unless Tasks 3.16 and 3.17 apply, Task 4.17 does not need to be completed unless Tasks 4.15 and 4.16 apply, etc. It follows that if the project does not involve a reduction of agricultural production nor a reduction in wood harvesting after the project start date, then leakage related to these factors would be considered to be zero.

The project proponent must reevaluate for leakage and GHG emissions on an annual basis using this approach to ensure that changes in GHG emissions are accurately accounted for throughout the project period. For example, in the case of a grazing project there may be an increase in herd size or total animal mass that is grazed, which would necessitate quantifying the GHG emission impact following the protocol described in VM0035.

# 2.5 Permanence

The project must be subject to a contractual commitment by the landowner/legal custodian to maintain any carbon accrued and stored in the soil carbon pool for a minimum of 10 years beyond the crediting year, and this 10-year contractual commitment must renew annually during the crediting period. A detailed report of baseline soil carbon stocks at the project site must be prepared as part of the project design document.

Once that minimum 10-year commitment condition is met, the number of credits withheld in a buffer pool is determined by one of the following methods:

> **Option 1 - Retainage:** 10% of the credits issued from the project will be withheld in a buffer account and released at the end of the crediting period of no shortfall during the crediting period occurs and minimal disturbance occurred during the storage period.
>
> **Option 2 - Pooling**: The number of buffer credits to be contributed to the Agriculture, Forestry and Other Land Use (AFOLU) pooled buffer account can be determined by applying the latest version of the VCS AFOLU Non-Permanence Risk Tool. Pooling only applies to contracts with a greater than 25-year commitment.

An annual verification step is required to ensure reasonable progress to estimated accruals, and the Project Proponent may update the Forward Assessment to reduce the issuance of interim credits based on site conditions or land management actions. The Buffer shall serve as the vehicle to ensure that reversal on a project can be addressed.

This standard deviates from VM0021 definition of Permanence. Projects under this standard are covered with a contractual agreement to implement regenerative and/or restorative management and the interim crediting provides financial incentives to the landowner to continue and improve upon these practices. The likelihood

of renewal of these projects is high considering the financial incentive for the landowner increases in the subsequent 5 year credit term renewals due to the cost of a single sampling event every 5 years, as opposed to the cost of 2 sampling events in years 1 and 5. With the landowner receiving the financial benefit of carbon credits and the ecological improvements driving reduced costs in agriculture and grazing, the project renewal is not only likely, but highly probable. VCS Validation and Verification Manual v3.2 discussed "the entire project longevity must be covered by management and financial plans that demonstrate the intention to continue the management practices."

# 2.6 Credit Release

Project proponent may select, or may be directed through the verification process based on the veracity of the soil carbon stock estimation method they have selected, to use one of three practices for determining credit releases, i.e.:

a. **Upon Verification Release:** - Up to 30% (net of buffer and applied estimation method discounting) of the projected available credits for the 5-year crediting period shall be available for immediate release upon verification of the project/portfolio plan. The intention of this release is to incentivize rapid scaling through increased participation by farmers, ranchers and conservationists and to enable positive cash flow in the early stages of carbon projects.

b. **Milestone releases:** - The project proponent shall identify critical release projection dates to meet farmer/rancher participation and project cash flow timelines. Milestone releases will only be based on bonafide baseline and repeated measurements of soil carbon stocks following VM0021 methods as prescribed above.

c. **Annual releases:** Based on confirmed, scientifically conservative carbon stock estimation methods and/or other surrogate vegetation sampling data, or the associated discounting of carbon stock estimation methods, the applicant may select a simple annual release based on estimated performance ultimately verified and adjusted by the T1 or subsequent 5-year measurement under Verra VM0021 requirements. Annual releases will be certified with the submittal of the checklist verifying that the assumptions in the original application continue as represented. Verification of the checklist and annual release of credit should be done within 10 business days of receipt. If a verification question arises, the applicant will have 5 business days to respond. It is critical that annual releases occur timeously to ensure cash flow to farmers, ranchers and conservationists and availability of registry credits to carbon credit purchasers. Annual releases can be moved to this standard and registry if a comparable method was used for the original verification.

# 2.7 Annual Checklist and Proof of Activity

Each rancher, farmer or conservationist shall annually provide documentation to the project proponent to confirm that the project activity(ies) have been deployed. Examples of such documentation may include:

a. Farm records from USDA, NRCS showing fields acreages, and confirming practices.
b. Independent on the ground third party confirmations.
c. Independent remote sensing third party confirmations.
d. Maps, acreages and written explanations of any deviations from a program plan including soil amendments, etc.
e. Financial, meteorological, marketplace, personal explanation of deviations from a program plan.
f. Rancher, farmer, or conservationist affidavit of continuation in program and compliance with Best Practice principles for regenerative ranching.

# 2.8 Independent Validation and Verification

Validation of the Regenerative Standard is done at initial issue and for subsequent major modification. Applied Ecological Institute as the host of the standard determines validation requirements post initial issue. Verification of the carbon credit project is performed utilizing the guidance and checklists in Section 4. Verification is performed by an independent 3rd party contractor with sufficient knowledge and experience to be able to ensure adequate technical review and verification of assumptions, calculations and conclusions.

# 3.0 Methods to Evaluate SOC Stock Dynamics and Accrual Rates

Under this standard, multiple methods are contemplated to incentivize rancher, farmer, or conservationist participation and make the cost of entry into this program low. To encourage these outcomes, multiple methods, each requiring a successive increase in investment and generating increasingly robust estimates and measures of soil carbon stock (and GHG) dynamics will be available for any project proponent to deploy on their project. Each method will support a forward assessment with commensurate and increasingly robust estimates and measures of soil carbon stock dynamics. Forward assessment guidance for each Method and the steps to complete applications for each Method will be described in Chapter 3, once these additional methods are developed.

The forward assessment may need to be made under different circumstances with differing levels of data quality. Depending on the availability of (site-specific) information and data, different methods can be used to make a conservative forward-looking assessment of stocks, stock changes and thus estimate carbon accrual rates. Six possible methods are shown here, and the appropriate method for any particular project can be selected by using the decision process shown in Figure 1. **Methods 1, 2, 3, 5, and 6 are Suspended: Not applicable for Version 1.0 of the Regenerative Standard.**

| | **Data Available at time of assessment** |
|---|---|
| **Method 1 Suspended** | Literature only, publicly available data and/or mapped soil carbon |
| **Method 2 Suspended** | Literature + shallow (≤30cm) sampling |
| **Method 3 Suspended** | Literature based model; non-site specific |
| **Method 4** | Up to 1-meter depth sampling of stratified landscape, random point allocation and sampling, lab bulk density and SOC, (Soil Organic Carbon) SIC, (Soil Inorganic Carbon) and TC (Total Carbon) measurement by taxonomic soil strata (VM0021 compliant.) |
| **Method 5 Suspended** | Same as Method 4 organized around chronoseries development to generate sampled period stocks and accrual estimates over time. (Chronoseries: a pair or group of sites that share similar attributes but represent different ages or time since adoption of regenerative land practices) |
| **Method 6 Suspended** | Same as Method 4 stratified in chronoseries, with site-specific calibrated model |

**Verra standards supportive of each Method**

| | | | |
|---|---|---|---|
| **Method 1 Suspended** | Interim Crediting Based on Literature SOC Accrual Rates and Site Vegetation Measurement | VM0026, | VM0021, VMD0019 |
| **Method 2 Suspended** | Interim Crediting Based on Literature SOC Accrual Rates and Shallow Sampling | VM0026, VM0042 | VM0021, VMD0019 |

| | | | |
|---|---|---|---|
| **Method 3**<br><br>**Suspended** | Interim Crediting Based on Literature SOC Accrual Rates and Predictive Model | VM0026, VM0042 | VM0021, VMD0019 |
| **Method 4, 5, or 6 must be deployed to prove up Methods 1, 2, 3 - typically within 12 months of initial assessment** | | | |
| **Method 4** | Interim Crediting Based on Site Stratification and Soil Sampling up to 1 Meter Depth | VM0021, VM0042, VM0026 | VM0021, VMD0019, VMD0018 |
| **Method 5**<br><br>**Suspended** | Interim Crediting Based on Site Stratification, Soil Sampling to 1 Meter Depth, and Chronoseries Data | VM0021, VM0042 | VM0021, VMD0019, VMD0018 |
| **Method 6**<br><br>**Suspended** | Interim Crediting Based on Site Stratification, Soil Sampling to 1 Meter Depth, and Chronoseries Data with a Site-Specific Calibrated Model validated with FLUX tower or other comparable technology | VM0021, VM0042 | VM0021, VMD0019, VMD0018 |

- ★ **Forward assessment and verification compliance with VMD0019.**
- ★ **Stratification and Sample Planning VMD0018, VMD0021**
- ★ **Additionality: ISO 14064 -2.**
- ★ **Verification and Validation: ISO 14064 - 2, ISO 14064 - 3.**

# 3.0.1 Project Documentation

Each section that follows describes, for a given method:

1. **Description of Land Management Activity VM0021**
2. **Stratification and Sample Planning VMD0018**
3. **Review of Reported SOC Accrual RatesVMD0019**
4. **Adjustment of Reported SOC Accrual Rates VMD0019**
5. **Interim Crediting Assessment VMD0019, VM0026**
6. **Application Completion VM0021 and ISO 14064 - 2.**
7. **Verification VM0021 and VMD0019**

Five (or timing at the proponent's discretion) years after baseline carbon stocks are measured, a second set of soil measurements is conducted at the same sampling locations to "true up" the assessment and provide the actual SOC stock change for a project.

Estimation of carbon stocks and accrual dynamics must be generated with a conservative scientific approach (i.e. stock/accrual estimates used for credit issuance must ensure a conservative number of credits are considered for issuance in advance, so that the credit is lower than the actual changes in carbon stocks projected to be measured in the future (i.e. ~>5 years' time). Project Proponent will use VMD0019 and VMD0021 to support this estimation process for the Project. Project proponents shall use landowner submittals and remote sensing technologies to ensure the project is monitored and reviewed during the annual verification process for any required estimate adjustments.

One approach by the proponent may be the use of Verra AFOLU Non-Permanence Risk Tool 19 Sep 2019 v4.0. The Proponent may use other techniques demonstrated to provide a conservative estimate based on studies, models and site specific attributes. Project proponents may choose to cap the forward assessment below the carbon storage estimate and buffer indicated with the completion of VCS Risk Report Calculation Tool v4.0 or other similar conservative approaches to ensure interim credits do not exceed the expected project carbon storage increase. Conservative estimates of carbon sequestration are available from USDA, FAO, Soil Reveal, and IPCC Tier 1 Methodology to serve as a starting point for the Project Proponent to build a site specific Carbon storage potential based upon the site and specific implementation of land management practices. Project Proponent documents the evidence to demonstrate a conservative assessment in the Application for the Project.

### 3.1.1 Method 1: Interim Crediting Based on Literature SOC Accrual Rates and Site Vegetation Measurement

### 3.1.2 Method 1: Interim Crediting Based on Literature SOC Accrual Rates and Site Vegetation Measurement – Worked Example

### 3.2.1 Method 2: Interim Crediting Based on Literature SOC Accrual Rates and Shallow Sampling

### 3.2.2 Method 2: Interim Crediting Based on Literature SOC Accrual Rates and Shallow Sampling - Worked Example

### 3.3.1 Method 3: Interim Crediting Based on Literature SOC Accrual Rates and Predictive Model

### 3.3.2 Method 3: Interim Crediting Based on Literature SOC Accrual Rates and Predictive Model - Worked Example

### 3.4.1 Method 4: Interim Crediting Based on Site Stratification and Soil Sampling up to 1 Meter Depth

Many farmers, ranchers and conservationists recognize the benefits of restoring their lands yet face economic barriers to adopting improved land management practices when challenged by the realities of cash flow positive operations. Method 4 is designed to address this issue through allowance of pre-sales of carbon credits based on early projections of soil carbon accrual rates supported by sampling soils up to a 1m depth (or first refusal) at appropriate sample points in the landscape determined through stratified landscape, random point allocation compliant with Verra VMD0018. At each sample point, soil samples are taken from each taxonomic soil strata/horizon. These samples are then submitted to an accredited soil laboratory to determine soil texture and gravel content (unless both have already been accurately quantified), soil organic carbon (SOC), soil inorganic carbon (SIC) and total soil carbon (TC) contents, equivalent soil mass (if proponent is basing carbon storage calculation on soil mass), and lab bulk density. This data can be used in conjunction with carbon credit generation supporting adoption of improved land stewardship activities. A proponent must ensure that soil sampling collection and sample preparation permits application of equivalent mass if that calculation is planned for the project.

Eligibility for Method 4 requires the project proponent to document suitable literature or other data for forward assessments and to demonstrate the scientific basis for inclusion of the specific data and the reasons for exclusion of specific data. Site specific conditions of topography, climate, soil type, and vegetation shall be used to support the relevance of the references/data used for the project forward assessment. Other relevant considerations relating to uncertainty in carbon stock estimations for the Project arising from the literature (e.g. due to differences in geographic/spatial resolution of the studies, methodology, sampling strategies of the studies, etc) should be both referenced by the proponent, and used to determine the relevance of the data for SOC estimations of the project.

In addition to a project proponent's representation of the relevance of the literature to the specific project, the proponent will ensure any references are credible. Credibility may be surmised from either the publishing or peer review of the information or utilization of data sets from scientific agencies or groups (e.g. NASA, USDA, USGS). Published or unpublished data sets where the proponent can demonstrate both credibility and relevance to the specific project may also be incorporated.

Method 4 establishes a baseline SOC stock that will then be used to determine actual carbon accrual rates when compared to a subsequent SOC stock measurement (e.g. five years later). Typical information available for Method 4 forward assessments includes:

- BASELINE SOC STOCK: Publicly available digital SOC maps
- SOC ACCRUAL RATE: Literature value for management practice (Methods 1 and 2) or predictive modeling (Method 3)
- BASELINE SOC STOCK: Stratified random soil sampling to 1 m depth
- SOILS: Publicly available soils data (e.g., texture, clay content, soil depth, bulk density, pH)

- VEGETATION: On-site sampling or landowner surveys (e.g., aboveground biomass, dominant species, C3/C4, perennial/annual, %cover) and/or remote sensing (e.g. %cover, vegetation types)
- CLIMATE: Publicly available current and long-term drought, precipitation, temperature
- TOPOGRAPHY: Publicly available digital elevation models for slope and aspect
- LAND MANAGEMENT: Landowner survey with animal management (e.g., stocking rate and density, paddock areas, graze/rest duration), vegetation management (e.g. hay removal, tree/shrub removal, seeding or planting), amendments (e.g. manure, fertilizer, lime, irrigation, pesticides) and soil disturbance (e.g. tilling, tiling, land forming) cropping aspects, (e.g. mono-culture, rotational cropping, inclusion of green manures or fallow periods, inter-cropping with leguminous species,
- PREDICTIVE MODEL: Model designed to predict carbon sequestration potential based on similar project parameters.
- STRATIFICATION, Sample planning, sample collection, soil analysis: Verra VM0021 methodology
    - Stratification has been performed across the project area according to Verra's VM0021 methodology. Sampling plan has been designed and executed according to VM0021 (VMD0018).
    - Site specific soil sampling to 1-m depth has been conducted, sampled by soil and landscape biophysical stratification variables, and samples have been lab analyzed by pedologic strata for BD, SOC, TC, SIC
    - Only baseline sampling has been conducted. There is no second time series set of measurements yet.
    - Site-specific vegetation sampling data is available.

Method 4 involves seven steps for estimating soil carbon accrual rates based on literature and adjustment for local soil, vegetation, meteorology and land management practices. Method 4 Project documentation shall follow requirements established in Section 3.0.1 of this Standard.

## Step 1. Description of Land Management Activity

Information about historical, current, and planned future land management practices, type(s) of livestock, stocking rates, number and size of paddocks, average rotation frequency, forage information, mowing/bush hog, bale grazing, chemicals usage, and notable wildlife/plants must be collected to assess land management practices through landowner surveys or other means. Crops, cover crop activities and other agricultural practices are determined. Land management is assessed semi-qualitatively using multiple factors that govern success in soil restoration using grazing: Land management style, number of years of regenerative or holistic management practice, paddocks/acre and rotational frequency, livestock and wildlife diversity, grazing plan documentation, and specific individual holistic practices impacting soil health. This qualitative assessment determines how closely the reported grazing practices adhered to full implementation of regenerative grazing practices, sometimes called holistic management with the determination of a high, medium or low impact to the site conservative estimate of soil organic carbon accrual potential.

## Step 2. Stratification and Deep Sampling

A stratification process and sampling design, including sample point allocation, should be developed following guidance from Verra's VM0021, particularly modules VMD0018 - Methods to Determine Stratification, and VMD0021 - Estimation of Stocks in the Soil Carbon Pool, with the goal of quantifying the change in soil carbon stocks over time (e.g. as the difference between carbon stocks in T0 and T1) within the project area and to

increase measurement precision in a cost-effective manner. This information gathered will both quantify the current existing soil carbon pool and enable accurate projections of future conditions per unit area with statistical rigor.

The stratification process involves assembling data on the ranch landform, soil, hydrologic setting, and vegetation, and then selecting representative locations on the ranch for allocation of random soil sampling points. The general steps to follow for stratification include as described in VMD0018. Sample design and point allocation should follow guidance under the Clean Development Mechanism (CDM) A/R Methodological Tool Calculation of the number of sample plots for measurements within A/R CDM project activities as referenced in VMD0021.

Projects that utilize emerging technologies, for example satellite data, proximal sensing, and/or geospatial mapping, must demonstrate that the alternative methods of measurement predict SOC with sufficient accuracy to meet or exceed the requirements defined in VM0042, VM0026 or VM0021. Per Verra VM0042 Version 2.0 Appendix 4 (in review): "projects may use emerging technologies to determine SOC content if sufficient scientific progress has been achieved in calibrating and validating measurements, and uncertainty is well-described."

If above the uncertainty limit set by the Verra Standard used for the project, the project proponent would reduce the forward assessment by the percentage of uncertainty exceeding the uncertainty determined in the applicable standard, unless project proponent resolves the uncertainty utilizing:

1. VMD0021 6.5a and VMD0018 Step 7 or
2. Project proponent demonstrates statistically the project falls within the uncertainty percentage for the applicable Verra Standard utilized by the project proponent. With the development of technology in this area, the Standard ensures integration of quantitative methods that ensure the highest certainty of forward assessments consistent with published or publicly available methods. Project proponent may utilize quantitative mapping, such as machine learning or other geostatistical mapping, or process modeling to validate the confidence factor and uncertainty calculation for the project, and
3. Project proponents should provide evidence of the ability of an emerging technology to predict SOC content with sufficient accuracy through the development and application of adequate calibration with data obtained from classical laboratory methods, such as dry combustion. The site characteristics for the underlying calibration must match the project site conditions, including range of SOC stocks, soil types, land use, etc. While projects may use the services of companies measuring SOC, the specificities of the applied measurement technology, including calibration methods, must be made available for review by a VVB. They must not have restricted access through intellectual property rights (reference VM0042.)

Project proponents may meet or exceed the Verra standard confidence and uncertainty factors (VM0042, VM0026, or VM 0021) and utilize project statistically significant factors for SOC analysis and utilize emerging technologies per VM0042 Appendix 4. Statistical confidence and uncertainty must be demonstrated at the appropriate spatial scale of the measurement method.

As required under VMD0021, laboratory methods should follow those described in the USDA Soil Survey Laboratory Methods Manual. Each subsample is tested as described below.

- Total Carbon via dry combustion
- Inorganic Carbon via modified Sherrod method (Sherrod, et al 2002) with Organic Carbon calculated as the difference between Total Carbon and Inorganic Carbon, or Inorganic Carbon as the difference between Total Carbon by dry combustion and Organic Carbon by dry combustion with prior removal of carbonates (e.g. acid fumigation) (Harris et al. 2001)
- Bulk Density via Soil Health Institute method after Blake and Hartge (1986) , with a correction for coarse fragments if applicable as described in VMD0021

### Step 3. Review of Reported SOC Accrual Rates

A review of representative reported soil organic carbon accrual rates for similar ecological and environmental conditions and land management practices as the project area is necessary as a basis for initial interim carbon crediting. Appropriate literature includes, but not limited to, direct results reported from experiments, meta literature reviews, and extrapolations from experiments via models. Literature, data and study requirements are described in Section 2.1.

### Step 4. Adjustment of Reported SOC Accrual Rates Including Stratification and Deep Sampling

The ability of a project area to achieve a literature-based expected SOC accrual rate must be assessed and compared to the specific site data generated. Assessments must address the representativeness of the reported accrual rate to the project area, with necessary adjustments for local conditions related to the dominant factors known to affect variation in soil carbon stocks over time, such as soil properties, topography, vegetation, climate, and land management. Qualitative scoring or quantitative adjustments can be used as long as the estimates are defensible and credible.

Soil, vegetation, climate, and land management practices should be considered when adjusting reported accrual rates, as these are dominant factors influencing rates of carbon storage. Soil and vegetation conditions typically exhibit significant spatial variation and therefore should be appropriately characterized for the project area through, for example, field sampling and measurements of soil and vegetation with stratified random sampling, or, with spatially continuous data such as remote sensing imagery of vegetation conditions or maps of soil physical properties. In contrast, climate and land management practices are typically relatively uniform across a project area. In such cases, adjustments can be appropriately assessed at the whole project level.

Soil conditions relevant to SOC accrual potential include, but are not limited to, texture, percent clay content, soil A&B horizon depth, slope, drainage, water holding capacity and gravel content. Relevant vegetation conditions include, but not limited to, percent plant cover, percent native perennial grass cover, percent annual grass cover, C3/C4 fractions, percent fine and coarse litter, and percent rocks. Crops, cover crops and fallow field periods should also be described if applicable.

An appropriate system should be used to determine reproducible adjustments, such as ranking with higher rank scores corresponding to the higher potential for SOC storage. For example, areas of higher clay content, lower gradient slope, deeper A&B horizon, low tree cover, higher plant cover, and higher perennial grass cover have greater carbon accrual potential in grasslands and would therefore be assigned a higher score. The scores

for each parameter relating to soil, vegetation, climate and land management conditions can then be rolled up into a composite score for the entire project area. If, for example, stratification was used with vegetation sampling, stratum scores can be scaled to the project area by multiplying the stratum scores by the area of each stratum, summing the products, then dividing by the total acreage of the project area to produce a single weighted value for the entire project area.

Unlike the scoring for soil and vegetation, scoring for climate and land management practices would be done for the entire project area since they typically do not vary within the project area. Climate parameters that should be considered for SOC accrual potential include, but not limited to, the length of growing season, mean annual precipitation, drought status. Relevant land management factors include the number of paddocks, long rest periods, brush removal, etc. Ranking can be assigned in a similar manner as the aforementioned soil and vegetation scores, with a higher score corresponding to greater SOC accrual potential.

A single composite project area score can then be calculated, with more weight given to factors with greater impact on SOC accrual rates. For example, soil, vegetation and climate scores could be multiplied by a factor of 1 while land management scores by a factor of 2 given its greater influence on overall SOC accrual than the other factors. The weighted sum is then taken and divided by the total number of scores to give an overall rolled up project level score.

## Step 5. Interim Crediting Assessment

The composite project area score can be correlated to reported values for SOC accrual rates for different soil, vegetation, climate and land management conditions and with adequate detailed science-based adjustments for the site, the SOC accrual can be projected. Further, a safety factor can be applied using VCS Risk Report Calculation Tool v4.0 or similar technical methodology applied by the proponent as evidence of a conservative estimate. For applicants that integrate conservative factors into the site-specific application of a method for forward assessment which are scientifically based and confirmed through the independent verification process, an additionalconservative reduction need not be applied. This ensures a conservative estimate of carbon accrual rates and a conservative number of credits for issuance in advance of the final carbon credits generated from 1-meter soil depth sampling performed using VM0021 after ~5 years.

## Step 6. Project Application Completion

Project Proponent shall complete the Project Application consistent with each section described in Section 2 of this Standard. Project Proponent shall include references to all documents, studies and data used to support the Project Application and shall note compliance or deviation to VM0021. This standard is written to comply with VM0021 with the exception of Additionality which references ISO 14064-2. A reference section shall be summarized by the Project Proponent in the Project Application. The application and verification will follow VMD0019.

The project proponent shall select or establish criteria and procedures for identifying and assessing GHG SSRs controlled, related to or affected by the project as defined in the standard section on Leakage.

Based on the established criteria and procedures regarding Leakage, the project proponent shall identify GHG SSRs relevant to the project as being:

a) controlled by the project proponent;
b) related to the GHG project; or
c) affected by the GHG project.
d) frequency of monitoring and reporting and the project period, including relevant project activities in each step of the GHG project cycle, as applicable;
e) frequency of verification and validation, as applicable.

## Step 7. Verification

Consistent with Chapter 4 of the standard, the Verification Summary and the Verification Checklist for Method 4 includes technical, management practice and procedural evaluation of compliance with the Methodology requirements. Verification is completed by a third-party verifier with a completion of the Verification Summary and Checklist. Year 2 verification of Method 4 shall include a review of stratification, sample planning, sample handling and soil SOC results. 3.4.2 Method 4: Interim Crediting Based on Site Stratification and Soil Sampling up to 1-meter depth – Worked Example

### 3.5.1 Method 5: Interim Crediting Based on Site Stratification, Soil Sampling to 1 Meter Depth, and Chronoseries Data

### 3.5.2 Method 5: Interim Crediting Based on Site Stratification, Soil Sampling to 1 Meter Depth, and Chronoseries Data – Worked Example

### 3.6.1 Method 6. Interim Crediting Based on Site Stratification, Soil Sampling to 1 Meter Depth, and Chronoseries Data with a Site-Specific Calibrated Model validated with FLUX tower or other comparable technology

### 3.6.2 Method 6. Interim Crediting Based on Site Stratification, Soil Sampling to 1 Meter Depth, and Chronoseries Data with a Site-Specific Calibrated Model validated with FLUX tower or other comparable technology – Worked Example

# 4.0 Verification Guidance and Checklist

This standard is perhaps the only standard that will allow for very rapid scaling at decreasing cost over time. This method also foundationally introduces a new test for additionality by asking the simple question-- if the soil is depleted of soil carbon, is there capacity for improving the soil carbon content? If the answer is YES, then any landowner with this condition can participate. If the answer is MAYBE, the landowner can still participate because the performance measurements dictate final trued up credit yields. Thus, by allowing all project activities, farmers, ranchers and conservationists are incentivized to be creative to rebuild/regrow soil carbon stocks on their land. With some sideboards (no undocumented unaccounted imported carbon materials--mulches, lime, earthmoving that moves carbon (soils) around the landscape, are not allowed)

**Introduction**

This document provides guidance for verification of carbon projects that might be brought by project proponents before the verifier team. The intent of this document is to frame how verification is to be conducted. In short, a streamlined, rapid and defensible, process is defined that allows verifier's, project proponents, and approving bodies and credit purchasers and farmers, ranchers and conservationists to understand projects, understand representations and claims by the project proponents, and to provide a clear decision pathway for all parties to understand conclusions. Conclusions can be approvals and concurrence with the claims and representations. But they may also be interim requests for more information, clarifications, or the recognition of a fundamental problem that would not support a determination about application completeness, or support the claims and representations suggested by the project proponent. Either way, this verification process is intended to create a clear record and to support resubmittals and completion of a review, and clear, open and transparent communications by the verifier and all others involved.

The majority of this verification guidance is focused on using a checklist process. Checklists one of the most efficient methods for streamlining the review process to ensure that all procedures are evaluated all standards are met, and to generate a very simple report consisting of the checklist and follow up attachment of no more than one page in length that identifies deficiencies discrepancies, additional information needs should there be a determination that the application is incomplete, or that any of the checklist items do not meet the test of sufficiency. **Checklists will be developed for the Methods included in this standard. For v1.0, a Method 4 checklist has been created.**

This standard is very different from all others by not focusing on any particular or specific activity change. Another significant simplifying foundation to this standard is that if the soil has capacity to store additional soil carbon, then the landowner is eligible to participate. These two guideposts greatly simplify who can be involved in carbon programs that are easily tracked with the measurement standard set by this standard, record keeping for verification are more cost effectively managed and confirmed for a project over time.

Fundamental to this standard, and thus this verification process, must be the recognition that the proof is always in comparing forward assessments for interim crediting with actual baseline (T0) and follow-up measurements (T1). This means that representations in a project plan document, often the first document reviewed by verifiers, only have material value when the baseline and subsequent follow-up measurements document performance. This method can use modeled or literature review projections early but only measured performance is used for truing the actual credit yield by a project. As a result of this fundamental

difference between this standard and all others, the initial baseline verification process has more of a perfunctory nature and not a decisive conclusion about performance or the credit yields. Simply put, if the checklist of submittals is complete, and the content of the submittals are reasonable as defined, "to support the understanding of the project proponents program", and if the "measurement systems proposed to document future performance are technically defensible", then the verification of the program is designed to provide rapid and low cost affirmative conclusions from a verifying entity.

This clarity means verifiers only have to assess reasonableness and not create alternative schemes for enumerating credit yields, or GIS or other modeling to test different interpretations of the credit yields associated with any project proposal. Instead, there are only two primary decisions to make during a verification:  is the accuracy of projected or measured baseline carbon stocks or accrual rates reasonable, and is the proponent forward assessment reasonable to ensure the proponent does not over-sell credits beyond the projected credit yields?

During the verification by comparison of T0 and T1 resampling results, the questions are identical: is the accuracy of the estimation(s), and actual measured baseline (Time Zero) and resample period (Time One) carbon stocks or accrual rates reasonable, and is the proponent accrual rate  reasonable to ensure the proponent does not over-sell credits beyond the projected credit yields.

**Land Tenure**—All methods have been stymied by the complexity of trying to overcomplicate land tenure documentation including gathering legal ownership documentation for each property in a proponents project plan. Under this method, whether a lease holder, owner, holder of a conservation easement over the land, or if the land is held in trust by a farm management organization, or other variants on land tenure (that change all the time), all that is needed for submittal under this standard is a) a map showing the land represented and included in a proponents project plan, and b) A letter statement of land control or collaborative and/or coordination influence of land management decisions on the included parcels for the duration of the carbon crediting period. Documentation of this statement can be provided via documented agreement from the land owner, or state or federal agencies approving long term leases of land management.

# Verification Summary

| | | | |
|---|---|---|---|
| Project Name | | Submittal Date | |
| Project Proponent Name | | Project Contact Info | |
| Verifier Name | | Verifier Contact Info | |
| Verification Receipt Date | | Verification Review Date | |

**Summary of Findings:**

1. Proposal Complete/Incomplete. If the Proposal is Incomplete, see detailed information requested below to finalize review:

2. Proposal does/does not meet tests of eligibility, additionality, permanence and leakage of the standard. If does not meet tests, see detailed necessary information below to re-evaluate and revise review:

3. Baseline method deployed defensibly/deployed indefensibly according to Method _____. If deployed indefensibly, see detailed necessary information below to re-evaluate and revise review:

4. Projected credit yield reasonably meets the requirements under Method _____. If the projected credit yield does not meet the test, see detailed necessary information below to re-evaluate and revise review:

5. Projected credit yields reasonably meet requirements under Method____. If proposed accrual does not meet the test, see detailed necessary information below to re-evaluate and revise review:

6. Verifier Summary

    a. Project reasonably meets all tests of the Method _____ used.
    b. Project Carbon credit yield analysis and accrual reasonably meets all tests of Method ___.
    c. Resolution of Material Discrepancies was complete and timely.
    d. If Method 4, 5 or 6: Computations comparing baseline (Time Zero) to repeat sampling (Time One, Two, etc.) provide a reasonable measured estimate of carbon stock changes over time (Accruals) and calculations of average annual rates of accrual that have been used in making landscape projections over the project area.

# Verification Checklist Record

**CHECKLIST RECORD METHOD 4**

Step 1. Project Definition and Property Definition

| | |
|---|---|
| Summary of proposal content complete (1 page) | Y / N |
| Documentation of Ownership or Control of land provided | Y / N |
| Anticipated activities are defined | Y / N |
| Land Tenure Representative identified | Y / N |
| Measurement team identified | Y / N |
| Biophysical strata defined in a table and acreage of each strata sampled. | Y / N |
| Measurement METHOD at T0 and T1 are identified for Baseline and resampling | Y / N |
| Annual verification: Landowner did not break minimum soil disturbance commitment | Y / N |
| Annual verification: Any significant infrastructure improvements have been documented in the application and, if necessary, any adjustments to the previous and forward assessments have been accounted for. | Y / N |
| Annual verification: Any significant change to property boundaries or erosion events have been documented in the application and, if necessary, any adjustments to the previous and forward assessments have been accounted for. | Y / N |
| Annual verification: Any submitted project records or plans are consistent with application | Y / N |
| Annual verification: Land management practices have continued or improved on site | Y / N |
| For any non-optional item marked N, what specific information is needed: | |

Step 2. Eligibility Met

| | |
|---|---|
| Eligible under Method proposed for project. | Y / N |
| Project meets Additionality defined. | Y / N |
| Project meets Permanence under rolling ten year definition beginning at T0. | Y / N |
| Leakage requirements met under the standard definition. | Y / N |
| Project meets commitment to timeline. | Y / N |
| Project meets commitment to proprietary data sharing with standard. | Y / N |

| | |
|---|---|
| Project is not mandated by law or regulation | Y / N |
| For any item marked N, what specific information is needed: | |

Step 3. Project Submittal Content Complete

| | |
|---|---|
| Project site description, map, acreages complete. | Y / N |
| Landowner assurances are in place for carbon representation by a carbon broker, seller, aggregator to meet marketplace assurances for the permanence period proposed. | Y / N |
| Land use history. | Y / N |
| Climate, vegetation, soils and topography adequately characterized. | Y / N |
| Landowner Management impacts adequately characterized. | Y / N |
| Proposed activity description next 10 years. | Y / N |
| Activity documentation level met past 5 years if T0 data was collected 5 years prior. | Y / N |
| For any non-optional item marked N, what specific information is needed: | |

Step 4. Stratification

| | |
|---|---|
| Stratification grounded in reasonable accurate biophysical mapping. | Y / N |
| Random sampling layout reasonably representing the strata defined by stratification. | Y / N |
| Mapping of strata, rationale of stratification is clear and reasonable. | Y / N |
| Sample layout is reasonable. | Y / N |
| Sample collection process is reasonable. | Y / N |
| Field monitoring equipment was calibrated. | |
| For any item marked N, what specific information is needed: | |

Step 5. Lab Results and Secondary Use of Data

| | |
|---|---|
| Lab results are certified and computations meet standard deviation for stocks and accruals. | Y / N |
| Secondary use of lab results is identified and appropriate. | Y / N |
| Calibration uses of lab results for chronosequence regression, flux tower computations of flux mass balance, estimation of accruals and projected stock increases over time. | Y / N |
| Calibration of monitoring and testing equipment is confirmed. | Y / N |
| Annual Verification: Baseline sampling was conducted in accordance with application | Y / N |
| Annual Verification: Confirm soil baseline laboratory results available from a qualified soil lab | Y / N |
| Annual Verification: Soil organic carbon and bulk density measures are consistent with standard | Y / N |
| For any item marked N, what specific information is needed: | |

Step 6. Carbon Projection

| | |
|---|---|
| Baseline definition reduces uncertainty and is calculated based on T0 1m depth sampling and if emerging technologies are used, project proponents provide adequate justification. | Y / N |
| Tabular projections of time, stock change, and rolled carbon stocks are reasonable. | Y / N |
| Project uses data and methods that enable meaningful comparison of GHG data. | Y / N |
| Mean stock change variance and level of discounting selected and applied in existing, five years past look is applicable, and five year forward estimates are reasonable. | Y / N |
| Project results would not have been possible without the Carbon project | Y / N |
| For any item marked N, what specific information is needed: | |

Step 7. Carbon Credit Representation

| | |
|---|---|
| Technical justification of credits requested is complete and reasonable. | Y / N |
| Adequate, appropriate and defensible discounting applied if needed. | Y / N |
| Project conforms to applied methodology and the project is likely to generate verifiable carbon storage data when fully implemented. | Y / N |
| Monitoring procedures are in place & removals are materially accurate. | Y / N |
| Materiality is assessed. | Y / N |
| Reasonable assurance that project assertions are free of material errors, omissions and misrepresentation. | Y / N |
| Quantification of the carbon storage is likely to be achieved by the project activity | Y / N |
| Equations, data, and parameters are reasonable and appropriate | Y / N |
| Carbon stocks and accrual projections align with existing published values. | Y / N |
| a. Uncertainties with respect to GHG measurements, estimates and calculations have been reduced as much as practical and estimation methods avoid bias. | Y / N |
| b. Assumptions, values and procedures used in the project do not result in overestimation in the quantification of estimated soil carbon storage. | Y / N |
| c. If Carbon stocks and accrual values are not aligned with existing published values above, has this resulted in a material change in technology, measurement, soil carbon stock and/or accrual estimation procedures? If yes, is the estimate enough to allow the credit yield proposal to be granted approval and be resolved with additional sampling following this standard? | Y / N |
| For any item marked N, what specific information is needed: | |

Step 8. Verification

| | |
|---|---|
| Verification granted as Generally Recognized as Satisfactory review results. All representations are adequate to meet QA/QC, measurement and discounting assumptions of the standard and a satisfactory defensible package and representation has been presented. The actual performance measurements in the future will determine the actual number of carbon credits. At this time, the representations are generally recognized as satisfactory. | Y / N |
| Verification granted as Generally recognized as Satisfactory with minor suggested changes in the project proposal as defined below: | Y / N |

| | |
|---|---|
| Verification granted as Generally recognized as Satisfactory with major suggested changes in the project proposal as defined below: | Y / N |
| Verification provisionally granted at a discount level that is different and adjusted to ___XXX% over the requested carbon credits. Describe technical basis and logic regarding proposed credit discount adjustment: | Y / N |
| Verification Not Supported by Submittal at this time. Describe technical basis and logic regarding decision and define what additional information is needed at this time: | Y / N |

Step 9. Proponent Response to Verification

| | |
|---|---|
| Project proponent may accept the verification level by the verifier and are required within 15 days to provide the Standard registry with a letter of acceptance of the verification. | Y / N |
| Project proponent may resubmit within 45 days the additional justification requested by the verifier to meet the level of verification the verifier and proponent can agree to achieve with the additional information. | Y / N |
| Verifier has 30 days to review additional justification and grant the verification level for which the additional justification was provided. | Y / N |

Step 10. Carbon Credit Certification

| | |
|---|---|
| Registry must notify project proponent of intent to accept verification.. | Y / N |
| Registry has up to 30 days to approve, serialize and place the approved credits in the carbon credit ledger. | Y / N |
| Registry by day 30 must notify the project proponent of the decision level of certification or non-certification of the results. | Y / N |

Addendum 1: Regenerative Land Management Practices

This table is intended to give an outline overview of land management practices and the potential impacts.
The table is not complete and is intended to be frequently updated as new research data becomes available.
The table is intended as an overview, not as a guideline to prescribe or plan practices on a certain property.
Practices should be implemented within the context of the property.

| **Ecological Impacts** | Improve Soil health | Improve Ecology Health | Increase plant biodiversity | Increase plant biomass | Increase soil microbiome diversity | Increase insect and bird quantity and biodiversity | Increase soil water holding capacity | Increase water quality | Increase Soil Organic Carbon [SOC] |
|---|---|---|---|---|---|---|---|---|---|
| **Regenerative Practices or Activities** | | | | | | | | | |
| Follow the six soil health principles | | | | | | | | | |
| 1. Know your context | | | | | | | | | |
| 2. Keep the soil covered | | | | | | | | | |
| 3. Minimize soil disturbance–physical (no-tilling, plowing), chemical, biological | | | | | | | | | |
| 4. Increase biodiversity above and below ground | | | | | | | | | |
| 5. Maintain continuous living plants/roots in the ground | | | | | | | | | |
| 6. Integrate livestock to improve soil health | | | | | | | | | |
| Increase soil organic matter percentage | | | | | | | | | |
| Increase soil water holding capacity | | | | | | | | | |
| Eliminate continuous grazing | | | | | | | | | |
| Forecast and plan grazing events and pasture rest periods in accordance with precipitation, forage growth, animal performance, and pasture recovery | | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Increase number of paddocks and rotations to decrease preferential grazing and encourage deep rooted high succession perennial plant species | | | | | | | | | |
| Practice adaptive multi-paddock (AMP) grazing | | | | | | | | | |
| Reduce or eliminate the use of synthetic fertilizers | | | | | | | | | |
| Reduce or eliminate the use of herbicides, pesticides, fungicides | | | | | | | | | |
| Reduce or eliminate dewormers in livestock | | | | | | | | | |
| Encourage native seed bank germination through management | | | | | | | | | |
| Revegetate the land through no-till native perennial seeding or planting | | | | | | | | | |
| Bale graze to improve soil health, sward diversity, etc | | | | | | | | | |
| Convert cropland back to native pasture (cropland, etc.) | | | | | | | | | |
| Protect and/or restore riparian areas | | | | | | | | | |
| Mitigate soil erosion and restore erosion areas | | | | | | | | | |
| Practice agroforestry-the intentional integration of trees and shrubs into crop and animal farming systems | | | | | | | | | |
| Use cover crops | | | | | | | | | |
| Crop residue retainage practices | | | | | | | | | |
| Reduce or eliminate heavy equipment use to decrease compaction | | | | | | | | | |
| | proven effect | anticipated effect | No effect | | | | | | |