Comments on CAR Soil Enrichment Protocol Version 1.0 – Draft for Public Comment

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May 18, 2020
https://www.climateactionreserve.org/how/protocols/soil-enrichment/

We would like to thank the Climate Action Reserve for the opportunity to provide comments on its draft *Soil Enrichment Protocol, Version 1.0* (SEP). The role of agriculture in mitigating climate change is important not only for its direct impact on climate gases but also indirectly through the development of resilience to climate change impacts predicted over the coming decades.

Selling GHG credits in an agricultural offset program requires a high level of certainty and a robust risk management account system as offset sales result in GHG emissions to the atmosphere elsewhere and many credits are reversible. It is our position that achieving that level of certainty and risk management capabilities cannot be achieved at the project-scale but rather requires a regionally coordinated landscape-scale program structure. Regional verification will be required to ensure that there are real net changes in carbon stocks and reductions in other GHG emissions. The complexity of the project level framework proposed in the SEP could lead to perverse outcomes, inadvertent and deliberate, that will result in little confidence that when all the actions taken in a region are considered that the projects will reflect a net GHG reduction in the atmosphere – the key test of the viability of the approach being outlined.

Measuring soil carbon and N_2O emissions are difficult and expensive to do correctly and there is substantial debate in the scientific community about how to correctly measure SOC. Current models lack sufficient validation to accurately predict SOC and N_2O dynamics at the field level and may only achieve sufficient certainty when applied over large numbers of acres. The size of anticipated annual SOC enhancement levels are small relative to the existing SOC stock and the literature suggests achieving statistically significant measurable enhancements will require continuous application of conservation practices for a decade or more. Therefore, no soil enhancement credits should be sold until soil measurements confirm SOC sequestration with statistical significance (at 95% confidence). Furthermore, SOC sequestration should be compared to a baseline established by validated soil measurements (not modeling.) There is also growing evidence in the literature that [SOC] down to a meter responds to changing land-use practices, often in the opposite direction of surface soil trends, indicating that the 30 cm depth requirement of the SEP will inadequately reflect net atmospheric changes. The SEP seems to assume that the change in carbon stocks of deeper soils are independent of surface soil processes and if there is a change it will be an increase in carbon. This assumption seems non-robust and as such has profound impacts on the determination of net changes in soil carbon storage.

While the SEP does include consideration of soil N_2O emissions, it doesn't require consideration of the potential increases in direct and indirect N_2O emissions when considering SOC enhancements. As the C and N cycle are inextricably linked, net GHG changes based upon SOC enhancement need to consider both SOC sequestration and N_2O emissions. This is especially true if N fertilizer application rates are increased which is not mentioned in the SOC quantification methods provided in the SEP. The role of elevated N_2O (or CH_4) emissions due to project activities over the course of the project years is also not considered in the reversal risk management accounting approach provide in the SEP. Bottom line is that the only practicable way to address this issue might be making projects that increase the use of nitrogen fertilizers ineligible for crediting under this protocol.

In addition to the inherent problems a project-based system would have with providing confidence to civil society that emission reductions have actually happened, the SEP lacks transparency as records of required measurements and modeling results would not be made publicly available. Transparency would also provide critical data to help improve the understanding of soil C and N dynamics and the quality of models.

Permanence:

Permanence of reversible credits for 100 years is the only way to assure meaningful climate benefit. For example, the recently adopted California Tropical Forest Standard (as well as CAR's Forest Standard) which involve reversible C stocks, require 100-year permanence of reversible credits. However, guaranteeing permanence of reversible SOC in agricultural systems for 100 years using a project-based program is not realistic. As currently proposed, the mechanisms to provide for permanence of reversible emissions over 100 years in the SEP are inadequate. In a regional landscape-based system, it might be possible to achieve the equivalent of 100-year permanence through the use of buffer pools and integration of serial actions across a region.

Ton-year accounting:

The proposed ton-year accounting system trades off current benefits at the expense of future impacts to the climate (and to future generations.) If the SOC sequestration is later reversed, the atmosphere will see higher [CO2] and more severe climate impacts. Furthermore, ton-year accounting provides little incentive to prevent reversal after the project period ends.

Soil sampling uncertainty:

Sections *D.4 Sample and Measurement Error* and *D.6 Remeasured Soil Carbon Stocks* discuss sample location design and the average difference between [SOC] measurements relative to the prior [SOC] measurement. However, the requirement that increased sequestration in SOC measurements across time are statistically significant considering all uncertainty needs to be specifically stated and defined. The uncertainty in the soil sampling measurement itself is likely to be large and leaves open the potential that much, probably most, of the carbon credited without robust analysis of statistical differences would be no different from a zero increase until practices have been in place for a decade or more. The bottom line is that there has to be confidence that the sum of all of the projects reflects the net change of carbon being stored on the landscape-scale - the proposed approach does not do that.

While determining laboratory uncertainty is important, it is a relatively minor component of the uncertainty when compared to the uncertainty in determining total soil carbon and how it changes over time (e.g. soil heterogeneity effects on sample location and return measurements, changes across the entire active soil profile, effects of SOC on N_2O emissions, slow SOC accumulation versus rapid SOC loss, annual weather variation, climate change impacts, etc.) The lack of confidence in the net change being credited and the flexibility in sampling regimes leaves the protocol vulnerable to granting credits for practices and/or situations that do not yield net GHG benefits. If there is a desire for flexibility and keeping transaction costs low, the only way to ensure that gaming and uncertainty is not a large component of the net result is to collect and analyze data on a regional basis.

Modeling:

Current models do not have sufficient resolution to accurately predict changes at the field or even farm level without an enormous amount of empirical data that cannot be warranted by the market value of carbon. A regional landscape-scale approach could address these problems in a way that civil society can have confidence that the climate impacts claimed are in fact being realized.

Detailed Comments:

2.2 Project Definition

For the purpose of this protocol, the GHG reduction project is defined as the adoption of agricultural management practices that are intended to increase soil organic carbon (SOC) storage and/or decrease net emissions of CO2, CH4, and N2O from agricultural operations, as compared to the baseline

Comment: Need to clarify that GHG Reduction Projects (SOC increase and GHG emission reduction) are synonymous with "soil enrichment projects" as used throughout the text (e.g. in Section 6. Project Monitoring.)

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Enhancement Payments

Enhancement payments provide financial assistance to landowners in order to implement discrete conservation practices that address natural resource concerns and deliver environmental benefits. For government-funded enhancement payments, participants sign short-term contracts and receive annual cost-share payments specific to the conservation practice they have implemented. Examples of relevant enhancement payments include:

- NRCS Environmental Quality Incentives Program (2014 Farm Bill)
- NRCS Conservation Stewardship Program (2014 Farm Bill)
- NRCS Continuous Conservation Reserve Program (2008 Farm Bill)
- NRCS Wildlife Habitat Incentive Program (2008 Farm Bill)

The practices that are compensated for by the programs above are based on minimum, standardized definitions, and do not require monitoring and reporting on GHG benefits. Payments are tied to activity, but not performance. Because of this, Field Managers may pursue enhancement payments without restriction. Because every available enhancement payment is not comprehensively addressed by the protocol at this time, the Project Owner must still disclose any such payments to the verifier and the Reserve on an ongoing basis.

COMMENT: Enhancement payments by USDA or State agencies for Ag conservation practices should result in a discount (for cost share) if the only additional actions required for offset payment is monitoring and reporting.

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3.5.4 Permanence Period

2. The field automatically enters the permanence period monitoring procedures. a. If the grower has been shown to have maintained their adopted practice(s) for 5 years following the opt-out, then permanence monitoring may conclude.

COMMENT: The five year Opt Out provision ignores risks of unintentional reversals or sale of land whereupon land use could be changed.

5. Quantifying GHG Emission Reductions

page 29:
Baseline and project emissions are defined in terms of flux of CH_4, and N_2O and net flux of CO_2 in units of metric tons CO_{2e} per unit area per reporting period.

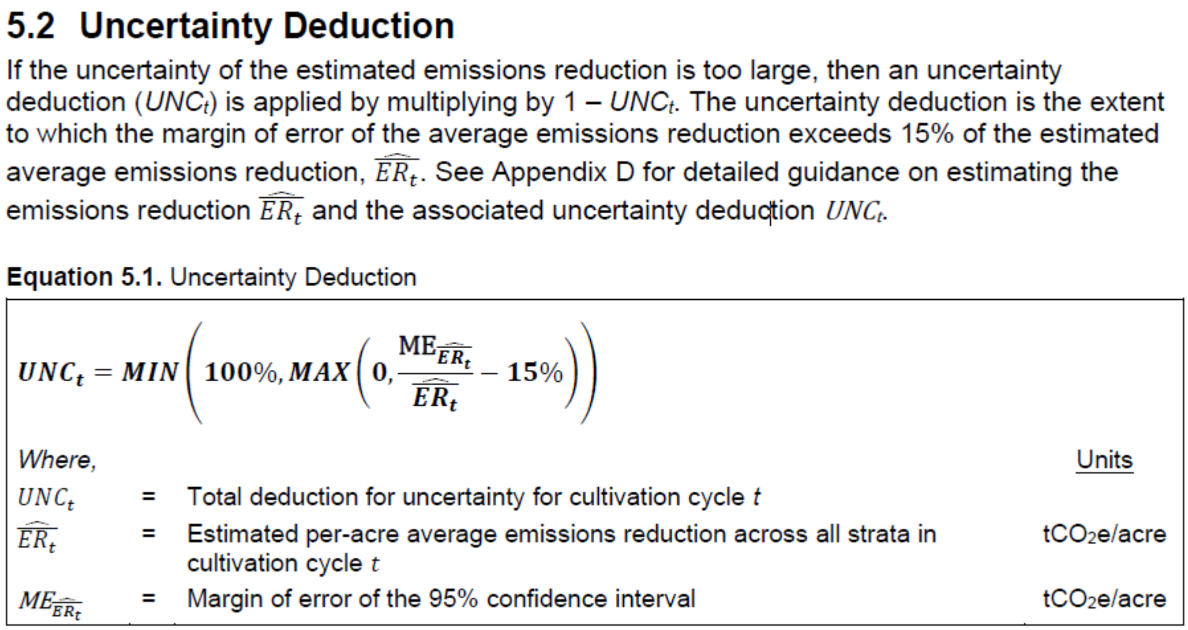
Comment – net flux of CH_4 *and* N_2O *are also important, not just net* CO_2*.*

Soil organic carbon levels must be directly measured in relation to the initiation of the project, as well as at least every five years thereafter. Using this directly measured SOC input, projects must model their baseline SOC stock change (as well as, optionally, CH_4, and N_2O emissions) during each cultivation cycle of the crediting period. Baseline emissions will be remodeled each year using climate data from the project cultivation cycle, following the guidance in Section 5.1.

Comment: Consideration of impacts to N_2O *emissions due to SOC stock change and/or any additional fertilizer application should be mandatory when assessing the net GHG benefits of SOC sequestration.*

Page 30:
A typical project will conduct soil sampling in relation to the project initiation (possibly using a model to adjust the SOC measurements backward to the project start date).

Comment: modeling backward in time to project initiation after project initiation should not be allowed as the calculated baseline and future SOC enhancement should be verified by measurement - a key component of this protocol.



5.2 Uncertainty Deduction

If the uncertainty of the estimated emissions reduction is too large, then an uncertainty deduction (UNC_t) is applied by multiplying by 1 – UNC_t. The uncertainty deduction is the extent to which the margin of error of the average emissions reduction exceeds 15% of the estimated average emissions reduction, $\widehat{ER}_t$. See Appendix D for detailed guidance on estimating the emissions reduction $\widehat{ER}_t$ and the associated uncertainty deduction UNC_t.

Equation 5.1. Uncertainty Deduction

$$\boldsymbol{UNC_t = MIN\left(100\%, MAX\left(0, \frac{ME_{\widehat{ER}_t}}{\widehat{ER}_t} - 15\%\right)\right)}$$

Where,

			Units
UNC_t	=	Total deduction for uncertainty for cultivation cycle *t*	
$\widehat{ER}_t$	=	Estimated per-acre average emissions reduction across all strata in cultivation cycle t	$tCO_2e/acre$
$ME_{\widehat{ER}_t}$	=	Margin of error of the 95% confidence interval	$tCO_2e/acre$

Comment: why was 15% chosen as the acceptable uncertainty? Seems high.

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5.5.1 Accounting for Leakage from Livestock Displacement

Livestock populations must be monitored in the project scenario in order to quantify project emissions from grazing activities (the calculation of CH_4 from enteric fermentation and manure deposition, as well as the calculation of N2O from manure deposition). In order to account for potential leakage, the level of grazing activity, as a function of both population and grazing time, must be monitored. To avoid crediting for emission reductions which correspond with emissions leakage, the level of grazing activity used to quantify project emissions may not be lower than the average level of grazing activity in the historic baseline period. Thus, if livestock displacement occurs, those emissions will continue to be counted in the project scenario as emissions leakage.

Comment: There is no specification on how long of a historic period of grazing is required.

If a grassland is being overgrazed, maintaining the same grazing pressure is not beneficial. Should consider addition of a feature that accounts for movement of livestock from overgrazed grassland to another beneficial grazing location, for example, integrating cattle into an existing crop system to graze on cover crops?

5.5.2 Accounting for Leakage from Yield Reduction of Cash Crops

In order to assess the risk of market-shifting leakage within the project, the project developer shall report the average APH across all acres of each crop within each cultivation cycle. If, for any given crop, in a given cultivation cycle, the difference between the project area APH and the regional average APH for the same crop, calculated as a “yield ratio,” declines by more than 5 percentage points, as compared to the average yield ratio for that crop during the historical baseline period, all emission reductions (both reversible and non-reversible) from strata containing fields producing that crop shall be discounted by that number of percentage points exceeding the threshold until a cultivation cycle where the difference between the project APH and the regional average APH for that crop no longer exceeds this threshold.

Comment: There is no specification on how long of a historic period of APH is required.

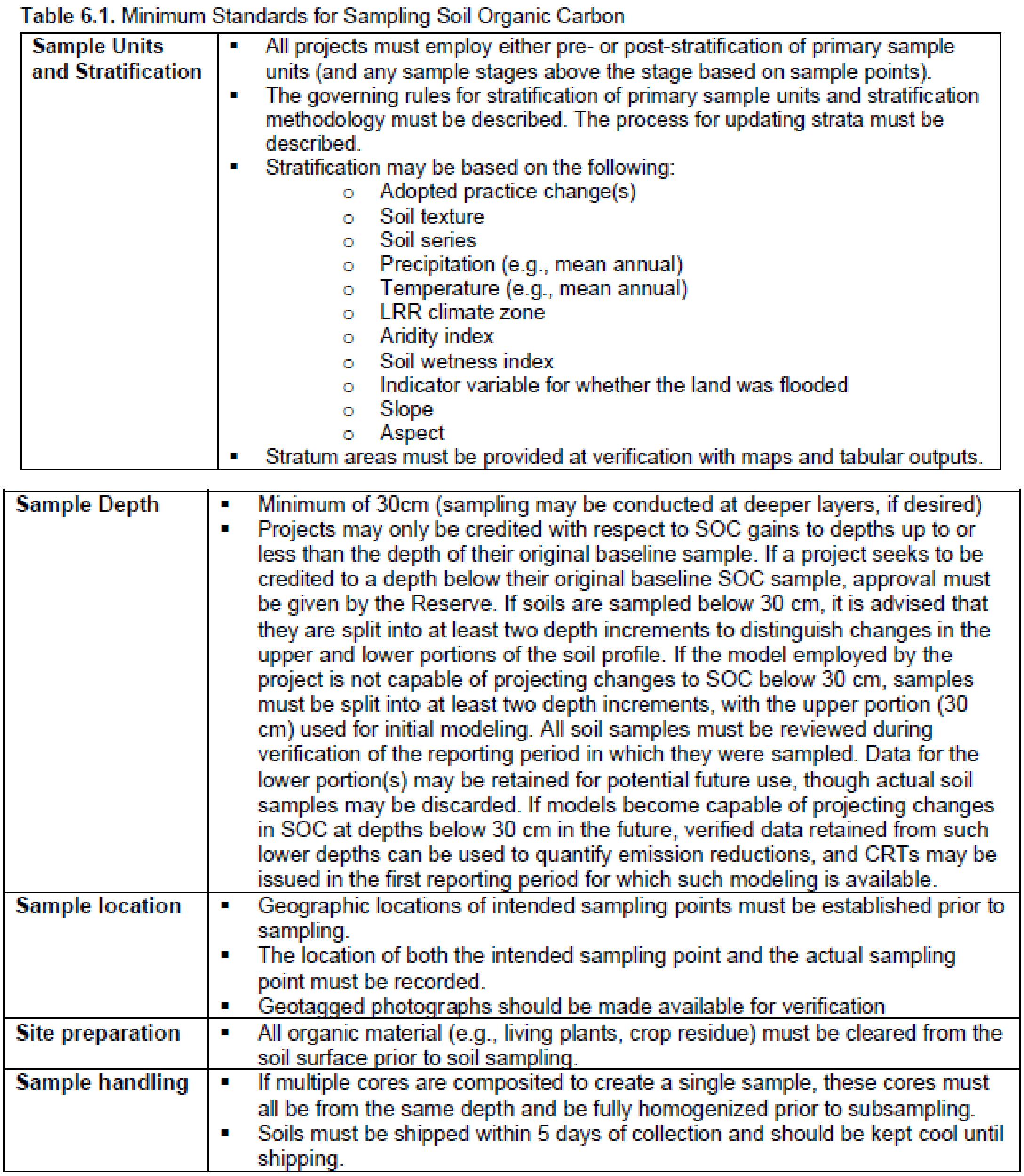

Table 6.1. Minimum Standards for Sampling Soil Organic Carbon

Sample Units and Stratification	▪ All projects must employ either pre- or post-stratification of primary sample units (and any sample stages above the stage based on sample points). ▪ The governing rules for stratification of primary sample units and stratification methodology must be described. The process for updating strata must be described. ▪ Stratification may be based on the following: o Adopted practice change(s) o Soil texture o Soil series o Precipitation (e.g., mean annual) o Temperature (e.g., mean annual) o LRR climate zone o Aridity index o Soil wetness index o Indicator variable for whether the land was flooded o Slope o Aspect ▪ Stratum areas must be provided at verification with maps and tabular outputs.
Sample Depth	▪ Minimum of 30cm (sampling may be conducted at deeper layers, if desired) ▪ Projects may only be credited with respect to SOC gains to depths up to or less than the depth of their original baseline sample. If a project seeks to be credited to a depth below their original baseline SOC sample, approval must be given by the Reserve. If soils are sampled below 30 cm, it is advised that they are split into at least two depth increments to distinguish changes in the upper and lower portions of the soil profile. If the model employed by the project is not capable of projecting changes to SOC below 30 cm, samples must be split into at least two depth increments, with the upper portion (30 cm) used for initial modeling. All soil samples must be reviewed during verification of the reporting period in which they were sampled. Data for the lower portion(s) may be retained for potential future use, though actual soil samples may be discarded. If models become capable of projecting changes in SOC at depths below 30 cm in the future, verified data retained from such lower depths can be used to quantify emission reductions, and CRTs may be issued in the first reporting period for which such modeling is available.
Sample location	▪ Geographic locations of intended sampling points must be established prior to sampling. ▪ The location of both the intended sampling point and the actual sampling point must be recorded. ▪ Geotagged photographs should be made available for verification
Site preparation	▪ All organic material (e.g., living plants, crop residue) must be cleared from the soil surface prior to soil sampling.
Sample handling	▪ If multiple cores are composited to create a single sample, these cores must all be from the same depth and be fully homogenized prior to subsampling. ▪ Soils must be shipped within 5 days of collection and should be kept cool until shipping.

Comment: Should provide minimum requirement on the number samples required per strata.

Stratification should be based upon consideration of all the parameters listed in Table 6.1 (and any others) as appropriate for the practice(s) being implemented.

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6.2 Monitoring Grazing

For each reporting period, Project Owners must provide both a quantitative and qualitative accounting of grazing activities for the reporting period. In terms of quantitative data, projects must document the type of livestock being grazed and the total animal grazing days for each type (Box 5.3). The livestock shall be categorized according to the categories in the Soil Enrichment Project Parameters spreadsheet20. These data are used for the parameter AGDl in Equation 5.12. The frequency of monitoring and the form of the documentation is not prescribed by this protocol. In terms of qualitative reporting, project developers shall include in their monitoring report a description of grazing activity for the reporting period and whether this conforms to the administrative mechanism in place to guard against overgrazing. Written confirmation from the entity or entities providing oversight with respect to this administrative mechanism should be provided to the verifier that no overgrazing has occurred during the verification period. The verifier shall use professional judgment to confirm with reasonable assurance that the quantification of project emissions from grazing is conservative, that effective monitoring of grazing has been maintained in accordance with this administrative overgrazing mechanism, and that no overgrazing has been detected using this administrative mechanism.

Examples of documentation that may suffice to demonstrate the quantitative grazing monitoring requirements may include (this list is not comprehensive nor is it intended to define sufficiency of documentation):

- Grazing logs (kept daily, weekly, or monthly) that specify the animal categories, populations, and grazing locations
- Animal purchase and sale records, assuming all animals are grazed on the project area
- Grazing management plan, assuming maximum allowable grazing activity

Comment: Some minimum frequency of grazing monitoring should be set.

Unclear how overgrazing will be determined. Some parameters or example models for estimating maximum allowable grazing activity should be identified to set minimum bar. CAR Grassland Protocol does not identify means to determine overgrazing.

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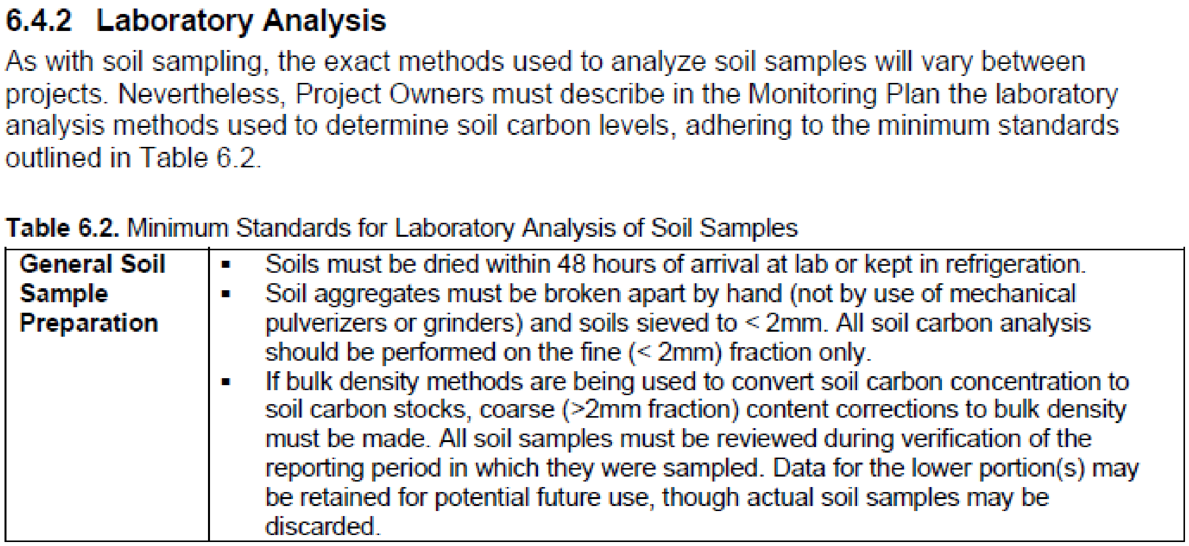
6.3 Monitoring Project Emission Sources

Otherwise, for each reporting period, the Project Owner must provide documentation for the following parameters used for the quantification of project emissions:

- Total acres burned and cause(s) of fire(s)
- Animal grazing days by livestock category
- Mass of fertilizer applied (other than manure from grazing), by type
- Nitrogen content of fertilizer applied, by type
- Purpose, type, and quantity of fossil fuels used (e.g., tractor, diesel, 100 gallons)

For project fields that employ fertilizer additions, it is strongly encouraged that the fertilizer application on those fields is guided by a nutrient management plan. Nutrient management plans should consider the principles contained in NRCS Conservation Practice Standard 590 for Nutrient Management. Where a project also incorporates irrigation, grazing, and/or the use of nitrogen fixing crops, such activities should be taken into account in developing any nutrient management plan for the project. Development of and adherence to a nutrient management plan is not required, but is strongly recommended.

Comment: Manure applied (other than from grazing) and its N content also needs to be reported and included in the nutrient management plan.



6.4.2 Laboratory Analysis

As with soil sampling, the exact methods used to analyze soil samples will vary between projects. Nevertheless, Project Owners must describe in the Monitoring Plan the laboratory analysis methods used to determine soil carbon levels, adhering to the minimum standards outlined in Table 6.2.

Table 6.2. Minimum Standards for Laboratory Analysis of Soil Samples

General Soil Sample Preparation	▪ Soils must be dried within 48 hours of arrival at lab or kept in refrigeration. ▪ Soil aggregates must be broken apart by hand (not by use of mechanical pulverizers or grinders) and soils sieved to < 2mm. All soil carbon analysis should be performed on the fine (< 2mm) fraction only. ▪ If bulk density methods are being used to convert soil carbon concentration to soil carbon stocks, coarse (>2mm fraction) content corrections to bulk density must be made. All soil samples must be reviewed during verification of the reporting period in which they were sampled. Data for the lower portion(s) may be retained for potential future use, though actual soil samples may be discarded.

Comments: These is evidence that a lot of carbon is found associated with the > 2 mm fraction and even with course fragments, rocks. The exclusive focus on <2mm is fine, but the impacts of this limitation has to be addressed. This consideration of a subset of the carbon stored in the soil adds to the uncertainty overall and needs to be considered in an uncertainty analysis of the determination of net change in carbon stocks.

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7.5 Record Keeping

For purposes of independent verification and historical documentation, project developers are required to keep all information outlined in this protocol for a period of 10 years after the information is generated or 7 years after the last verification.

Comment: CAR should commit to retaining the records for the full period of the PIA or beyond if a project wishes to claim credits beyond the PIA termination.

This information will not be publicly available, but may be requested by the verifier or the Reserve.

System information the project developer should retain includes:

- All data inputs for the calculation of the project emission reductions, including all required sampled data, as well as the results of emission reduction and sequestration calculations
- All modeling outputs (if applicable)
- Copies of all permits, Notices of Violations (NOVs), and any relevant administrative or legal orders dating back at least 3 years prior to the project start date
- Executed Attestation of Title, Attestation of Regulatory Compliance, and Attestation of Voluntary Implementation forms
- All verification records and results
- All maintenance records relevant to the monitoring equipment

Comment: The data on emissions, modeling outputs and verification should be publicly available both to provide confidence in the veracity of the credits and for the advancement of science and model accuracy.

Appendix D Quantifying Uncertainty
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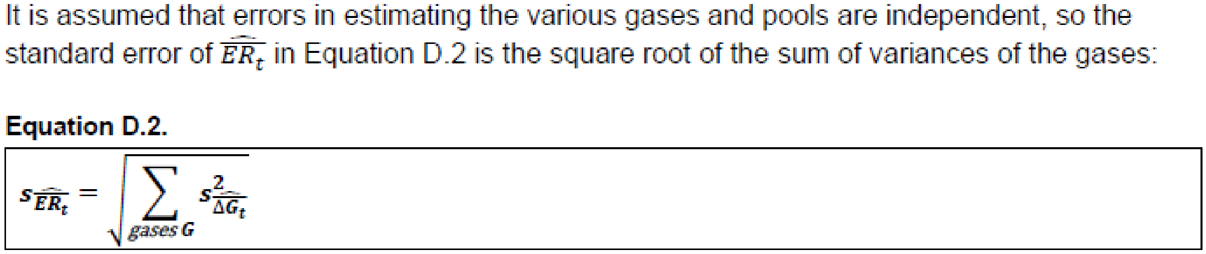

It is assumed that errors in estimating the various gases and pools are independent, so the standard error of $\widehat{ER_t}$ in Equation D.2 is the square root of the sum of variances of the gases:

Equation D.2.

$$s_{\widehat{ER_t}} = \sqrt{\sum_{gases\ G} s^2_{\widehat{\Delta G_t}}}$$

Comment: while errors in the pools (i.e. SOC) are mentioned once in the text above, they are not included in the description of Equation D.2 or the Equation D.2 itself.

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If a whole new set of sample points is chosen independently of the initial sample points, then the variance of Equation D.10 is the sum of the variances [Som (1995), eq. 24.16]:

Comment: Soil samples must be recollected from the same locations.